

VIRGIN ISLANDS NATIONAL PARK

**FINAL
ENVIRONMENTAL ASSESSMENT**

**Sustained Reduction
Of
Non-native Rats, Cats And Mongooses
From
Virgin Islands National Park**

**DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SOUTHEAST REGION**

OCTOBER 2001

This Final Environmental Assessment (EA) evaluates impacts from non-native rats, cats and mongooses in Virgin Islands National Park, describes control alternatives and proposes actions to reduce their populations. By reducing their population size inside the Park, adverse impacts to visitors, residents and natural and cultural resources will also decrease. Collectively, non-native rat, cat and mongoose populations pose a significant threat to the native natural resources, long-term resource management programs of the Park, and visitor health and safety. The Final EA document has been prepared in response to comments and concerns received during the public review of the Draft EA.

Availability

The Final Sustained Reduction of Non-native Rats, Cats and Mongooses from Virgin Islands National Park Environmental Assessment is available for public viewing at the following locations:

Elaine I. Sprauve Public Library
St. John, VI

Enid M. Baa Public Library
St. Thomas, VI

VINP Visitor Contact Station
Cruz Bay; St. John, VI

National Park Service Headquarters
Christiansted NHS; St. Croix, VI

The Final EA may also be viewed at www.nps.gov/viis or www.friendsvinp.org. Printed or electronic copies of the Final EA can be requested from the National Park Service at the following address:

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to assure that their development is in the best interests of all. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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I. CHAPTER I: PURPOSE AND NEED

I.A. INTRODUCTION

The purpose of this document is to evaluate the short-and long-term environmental consequences of a sustained reduction of non-native rats (Norway Rat, *Rattus Norvegicus* and Tree Rat, *Rattus rattus*), non-native Domestic Cats (*Felis catus*), and non-native West Indian Mongooses (*Herpestes auropunctatus*) from Virgin Islands National Park, St. John, U.S. Virgin Islands.

NPS Natural Resources Management Guidelines (1991, Chapter 2, Page 286) require that for each non-native species present within a National Park Service unit, an individual management and monitoring program be tailored to the particular park setting. This program includes a species evaluation, development of an information base, monitoring, initiation of management actions, and establishment of an institutionalized follow-up program.

National Park Service guidelines for compliance with the National Environmental Policy Act (NEPA) require an analysis of potential effects of this from the proposed activity on the affected environment. This environmental assessment reviews these potential impacts and the actions that would be taken to prevent and/or mitigate any adverse effects. As described in Section I.C, the National Park Service in cooperation with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division, proposes to conduct an island-wide non-native rat, cat and mongoose reduction program using a combination of trapping or rodenticide applications within Virgin Islands National Park.

I.B. PURPOSE AND NEED

The purpose of the proposed action is to undertake a sustained reduction of non-native rats, cats and mongooses in Virgin Islands National Park. By reducing their population size inside the Park, adverse impacts to visitors, residents and natural and cultural resources would decrease. The program purpose is to reduce non-native rat, cat and mongoose populations to levels where they produce minimal or no damage to Park resources or threats to visitor and employee safety. The program is therefore, termed a "sustained reduction," because once the non-native rat, cat and mongoose populations are reduced to acceptable levels, the smaller populations would be maintained at that level or below. Collectively, non-native rat, cat and mongoose populations pose a significant threat to the native natural resources, long-term resource management programs of the Park, and visitor health and safety. This program, however, does not address impacts associated with the presence and/or removal of other non-native animal species such as domestic goats, wild hogs, burros, domestic sheep and white-tailed deer.

People have accidentally or intentionally introduced hundreds of non-native species into natural communities worldwide, and while many die out, some persist and become pests (Stone and Loope 1996). It is now widely accepted that the current rates of species extinctions are dramatically higher than background rates; most current extinctions can be directly attributed to human activity; and for ethical, cultural, aesthetic and economic reasons, the current extinction rate is cause for considerable concern. Human-caused extinctions can be roughly divided into four broad categories: non-sustainable use of resources, habitat destruction, pollution, and introduced non-native species (Soule 1990).

Results of the first three categories are often acute and can directly affect human and native wildlife

welfare on an observable time scale. The human related impacts have made them the focus of public environmental concern. The introduction of non-native species has received less publicity and professional attention; however, introduced species are responsible for 39% of all recorded animal extinctions since 1600 for which a cause could be attributed (Treshy and Croll 1994). Thus, some impacts of introduced species are irreversible and at least as devastating as the other categories. Once established, introduced species often become permanent in ecological time unless intentionally removed (Treshy and Croll 1994).

Native wildlife in island ecosystems are particularly vulnerable to the first three categories as well as the impacts of introduced species. Of the 484 recorded animal extinctions since 1600, 75% have been island endemics. Introduced species were completely or partially responsible for 67% of these extinctions (based on the 147 island species for which the cause of extinction is known, calculated from the World Conservation Monitoring Centre 1992).

Islands are important for the conservation of biodiversity for four reasons: 1) a large percentage of their biota are endemic species and subspecies; 2) they are important breeding areas for seabirds, pinnipeds, and sea turtles, which forage over thousands of square kilometers of ocean but are dependent on relatively small amounts of protected land on islands for breeding and nesting; 3) many islands are sparsely inhabited or uninhabited by humans, keeping socioeconomic costs of protection low; 4) the species and ecological communities on islands have evolved in natural fragments, making them less susceptible than continental species to the problems of habitat fragmentation caused by small reserve size. In summary, by restoring and protecting islands, functioning unmanaged ecosystems can be maintained without large expenditures or significant conflict with local human populations (Treshy and Croll 1994).

Wild animals, which establish breeding populations after being introduced by humans, are termed exotic. Feral animals, by contrast, are introduced from domestic animals and establish breeding populations in the wild. Exotics are generally more frightened of humans, while feral animals can be very friendly to people. For simplicity purposes, all animals that establish breeding populations in the Park will be called “non-native.” All of these species disrupt complex native ecological communities, jeopardize endangered and native plants and animals, and degrade natural habitats.

Because the Park boundary is entirely coterminous with private or territorial lands, non-native animals readily enter from adjacent lands. Also, several hundred inholdings exist within the Park’s authorized boundary, and many have residences. Thus, non-native animals inhabiting adjacent lands would always enter the Park and attempt to establish breeding populations. For these reasons, the permanent elimination (eradication) of non-native rats, non-native cats or non-native mongooses from the Park is impossible and thus not analyzed as an alternative. Therefore, feasible alternatives must focus on regular efforts to reduce the population size and minimize concomitant and cumulative impacts from each species. The key is to manage populations in an Integrated Pest Management (IPM) approach that includes regular inspections and monitoring, upgraded sanitation, retrofitting trash receptacles, rat-proofing structures, and other measures.

The National Park Service Organic Act (16 U.S.C. 1 et seq [1988], August 25, 1916, sc. 408, 39 Stat. 535) mandates the parks to “conserve the scenery and the natural and historic objects and the wildlife therein...{to} leave them unimpaired for the enjoyment of future generations.” Changes to the natural communities from human actions in the parks, including the continuous and unabated invasion of exotic and feral species, are contrary to the intentions of the Act. Additionally, the NPS Organic Act, especially 16 U.S. C 3, authorizes the Secretary of the Interior to destroy animals that may be detrimental to parks; therefore comprehensive control of exotics and their effects in the NPS is therefore compulsory.

NPS is mandated to destroy animals that are determined to be injurious to native flora and fauna. Management of populations of exotic plant and animal species, up to and including eradication, will be undertaken whenever such species threaten Park resources or public health. High priority will be given to the management of exotic species that have a substantial impact on Park resources and that can be expected to be successfully controlled (NPS Natural Resources Management Guideline 1991, Chapter 2, Page 286).

The National Park Service is required to identify and promote the conservation of all Federally listed threatened, endangered, or candidate species within park boundaries and their critical habitats (see Appendix A, List of Endangered Plants and Animals of the U.S. Virgin Islands). The National Park Service is also required to protect all state and locally listed threatened, endangered, rare, declining, sensitive, or candidate species that are native to and present in the Parks, and their critical habitats (NPS Management Policies 2001; VINP General Management Plan (1983), pages 47-48). Guidelines for management of species Federally listed as threatened, endangered or candidates for listing are found in NPS management policies and natural resources management guidelines, National Park Service Management Policies (NPS 2001) and guidelines for natural resources management (NPS Natural Resources Management Guideline 1991, Chapter 2, Pages 268-279) establish the affirmative responsibility of NPS, and the individual Park, for managing both listed and candidate species. They also stress that management actions should emphasize removal of threats, but also active recovery efforts and that management should be done in an ecosystem context.

The Endangered Species Act (ESA) requires that actions authorized, funded or carried out by Federal agencies not jeopardize the continued existence of listed species. Under section 7(a)(2) of the ESA (16 USC section 1536), Federal agencies are required to consult with the U. S. Fish and Wildlife Service (USFWS) on actions which may affect listed species or critical habitat. Because this primary restoration plan proposes actions that may affect the 3 Federally listed plant species and 8 Federally listed wildlife species on St. John Island, NPS consulted with USFWS on likely effects to those species (Appendix E). The Sea Turtle Recovery Plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is, therefore, a violation of the Endangered Species Act. The USFWS determined that this proposed action will have no impact on listed species, in fact, it will most likely benefit them.

With the exception of bats, the Virgin Islands National Park is presently inhabited by numerous species of non-native mammals that have produced severe impacts on many indigenous species of plants and animals and threats to visitor safety (Appendix B). Feral or wild mammals include the white-tail deer, donkey, wild hog, domestic goat, domestic cow, domestic sheep, European boar, West Indian mongoose, tree rat, Norway rat and domestic cat, domestic dog and house mouse. Some of these species also threaten visitor experience and safety. With the possible exception of deer, increasing populations of these species are seriously affecting native species of plants and animals. Additionally, introduced species of birds, amphibians, reptiles, insects and plants are impacting the fragile environment (see Appendix B, List of List of Introduced Animals to St. John Island).

Norway Rats or Brown Rats (*Rattus norvegicus*) existed on St. John from the 1700's and were introduced by European explorers. Black or Tree Rats (*Rattus rattus*) existed on St. John from the earliest records and were also introduced by Europeans. Both species occur in Virgin Islands National Park and range throughout St. John, but the tree rat is considerably more common. Most problems arise from the nocturnal black rats, which reside in trees and generally forage at night. Tree rats are associated largely with people and human establishments and are known as commensal rodents.

As commensal rodents, Norway and tree rats are habituated to living near humans and except for an occasional predation by red-tailed hawks, they have no biological predators. Rats are omnivorous; they

eat nearly every kind of grain, fruit, fish, fowl, carrion, milk products, and vegetables. Several rodents can destroy hundreds of chicks in just one night. They are behaviorally plastic, have high reproduction rates, and can survive in a variety of habitats. These traits make them ideally suited to survive on a variety of predator free islands. Even if extinctions do not occur, rats can have ecosystem wide effects on the distribution and abundance of native species through direct and indirect effects. For example, comparisons of rat-infested and rat-free islands, or pre and post rat eradication experiments, have shown that rats depressed the population size and recruitment of birds, reptiles, plants and terrestrial invertebrates. Rats have also been shown to affect the abundance and age structure of intertidal invertebrates. The introduction of new *Rattus* species should be avoided, even to islands that already have introduced rats.

Domestic cats originated from an ancestral wild species, the European and African Wild Cat (*Felis silvestris*). The Domestic Cat (*Felis catus*) is now considered a separate species. The estimated numbers of pet cats in urban and rural regions of the United States have grown from 30 million in 1970 to nearly 65 million in 2000. Reliable estimates of the present total cat population are not available. Nationwide, approximately 30% of households have cats. In rural areas, approximately 60% of households have cats. Populations of birds on oceanic islands have evolved in circumstances in which predation from mammalian predators was negligible and they, and any other island vertebrates and invertebrates, are therefore particularly vulnerable to predation when non-native cats have been introduced.

The impacts of domestic cats on wildlife are difficult to quantify. However, a growing body of literature strongly suggests that domestic cats are a significant factor in the mortality of small mammals, birds, reptiles and amphibians. Because free-ranging cats often receive food from humans, they can reach population levels that may create areas of abnormally high predation rates on wildlife. When the wildlife prey is a threatened or endangered species, the results may be extirpation or extinction. Effects of cat predation are most pronounced in island settings (both actual and islands of habitat), where prey populations are already low or stressed by other factors, or in natural areas where cat colonies are established.

Non-native cats have and continue to threaten populations of reptiles and ground and shrub nesting birds as well as providing vectors for transmission of parasites and diseases to humans. Cats carry many diseases, some which may be passed to humans (cat scratch fever, various bacterial skin diseases) and others that are transmissible to domestic cats. Certainly, their feet and fur carry germs, which they invariably disperse in their wanderings. Cats also apparently like to defecate in the bathrooms and showers at Trunk Bay, producing very unsanitary conditions and additional work for Park employees. Several visitors have contracted “creeping eruption” (*Tinea corporis*, also known as ringworm), a fungal infection, while on the beach at Trunk Bay. This is transmitted via cat feces, probably deposited on the beach where conditions are favorable for bacterial survival.

Cats hunt for both fun and food. Unlike wild predators, domestic cats hunt whether they are hungry or not. These cats are called “subsidized predators” because they sometimes receive a steady supply of food at home. Pet cats can hunt longer and are less susceptible to disease than many wild predators. Because non-native cats routinely kill insects and other small animals for “sport” to practice their hunting skills, in addition to using them as a food source, great numbers of wildlife are lost each year to a small non-native cat population. A recent university study in Wisconsin ((Fish and Wildlife Today 1998) estimated that “1 to 2 million free ranging rural cats in Wisconsin kill roughly as many as 217 million birds each year.” Researchers noted that birds make up only 20 percent of the cats’ diet. Seventy percent of the diet was small mammals and 10 percent reptiles and amphibians (Patronek 1997; Coleman and Temple 1995). Thus, great numbers of wildlife can be lost each year to a small non-native cat population.

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In the 1880's, European planters introduced the West Indian Mongoose (*Herpestes auropunctatus*) to the Caribbean and to St. John as a biological control to suppress the tree rat populations that decimated sugar cane fields (Nellis and Everard 1983). It was thought to be the salvation for the large sugar cane plantations on the islands that were being ravaged by tree rats. At first, the statistics indicated that a significant decline in the rat population had occurred and the decline was attributed to mongoose predation. As a result, in the next 30 years (1872 to 1900), even more mongooses were brought to the islands and distributed throughout the Caribbean as a biological control.

Soon it was discovered that rats that sought out their meals at night didn't cross paths with the daytime foraging mongooses. Rats are nocturnal and sleep in trees during the day. They were therefore able to eat as much sugar as they wanted by night, while the mongooses were sleeping. The rats were safe, during the day, from the mongooses, which cannot climb trees. They coexist well and we now have both non-native species to contend with. Mongoose populations are scattered throughout St. John, with the highest concentrations near human populations, due to increased food availability. Mongooses have no biological predators and populations rise sharply when sufficient food quantities become available (Nellis and Small 1983).

Problems compounded as the rats continued to enjoy sugar cane and mongooses feasted instead on bird and sea turtle eggs, as well as, insects, papaya and guava. Public health concerns increased when the mongoose was discovered to be a carrier of rabies. Since mongooses have no natural predators here, the checks and balances of natural population control are missing. Non-native mongoose have devastated reptile populations, some bird populations and continue to depredate the nests of the endangered Hawksbill Sea Turtle (Coblentz, 1983).

Because reptiles, amphibians and invertebrates, such as insects, are small, often slow and readily available on St. John, they are particularly susceptible to local extinction from non-native rat, cat and mongoose depredation. Of particular concern are the varied native reptile and amphibian populations in the Virgin Islands National Park and their links to the ecological web of the island. Non-native rats, cats and mongooses prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1,500 beetle species; all of which may be eaten by rats, cats and mongooses.

Great numbers of wildlife, therefore, are lost each year to relatively small non-native rat, cat and mongoose populations. The cumulative impacts associated with these increasing wildlife losses are significant. Small islands typically have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts to a larger landmass.

Non-native rats, cats and mongoose prey upon endangered Hawksbill and Leatherback sea turtles, which nest on St. John. Norway and roof rats, cats and mongoose kill emergent hatchlings as they crawl from the nest to the ocean at night, when the rats are most active. Non-native rats, cats and mongoose will also prey upon sea turtle nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones. The Sea Turtle Recovery Plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is, therefore, a violation of the Endangered Species Act.

Non-native rats, cats and mongooses prey upon chicks, juveniles and adults of most bird species that nest on St. John. Of particular concern are endangered Brown Pelicans, Least Terns and threatened Roseate Terns. Territorial endangered species preyed upon by non-native rats, cats and mongoose include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck, and the Antillean Mango Hummingbird, all of which suffer egg and chick death due to rats. Non-native rats, cats and mongoose also prey upon four (of the five) native bat species, three of which are territorially endangered, and the only indigenous mammals on the island.

The Virgin Islands National Park General Management Plan (1983) and Resource Management Plan (RMP) (1999) identified the need to remove non-native animals from St. John Island. RMP objectives for management of non-native rats, cats and mongooses in Virgin Islands National Park, include:

1. Protect the native species and natural processes of the Park's ecosystems by reducing the impacts of non-native rats, cats and mongooses on these species and processes.
2. Protect critical habitat of rare, endangered, and endemic species, and reduce non-native rat, cat and mongoose impacts on identified areas that are particularly vulnerable to predation and disturbance.
3. Protect rare, endangered and endemic species, which are presently or potentially affected by activities of non-native rats, cats or mongooses.
4. Ensure the opportunity for visitor experience of undisturbed natural processes by reducing the effects of non-native rats, cats and mongooses' activity upon aesthetic and wilderness values of the Park.
5. Protect public health by monitoring non-native rats, cats and mongoose populations and individual animals for possible diseases communicable to humans, livestock or wildlife.
6. Minimize adverse effects of non-native rats, cats and mongooses control methods upon natural, cultural and human resources adjacent to the Park.

I.C. PROPOSED ACTION

The National Park Service in cooperation with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division proposes to conduct a site-specific non-native rat, cat and mongoose population reduction program using a combination of trapping or rodenticide applications within Virgin Islands National Park. In general, non-native rat, cat and mongoose populations are larger in or near areas of human development, in part because of the availability of food, and lowest in remote areas with few human dwellings or visitors. Key steps for a viable management plan includes: 1) establishes current and acceptable population estimates; 2) identify food sources, methods to reduce

available food and habitat; 3) develop strategies for reduction; 4) public education; 5) long-term monitoring; and 6) periodic removal. The approach must be integrated and include partnerships with concessionaires, adjacent landowners/inholdings and relevant community groups.

Especially essential would be reduced harborage and building access for rats, cessation of cat disposal and feeding on Park lands by residents, and elimination of human-created food resources for all species. Large populations can only exist if sufficient food is available. Therefore, when the food supply is reduced, the population would fall. Increased sanitation, more frequent trash pick-up, animal-proofed trash receptacles, and enhanced food preparation and storage practices would all reduce food availability. These actions must be well established before a large-scale population reduction effort is initiated. Habitat reduction methods are very important to limit population growth, particularly with non-native rats. Changing landscaping practices and sealing access to buildings are inexpensive remedies for habitat reduction. Periodic inspections by qualified personnel are necessary to minimize new harborage and rodent access.

A single, rapid population reduction effort is necessary to reduce the present populations to an acceptable level. Because additional non-native rats, cats or mongooses can enter the Park from adjacent lands, an acceptable population size (limit) must be established. The population must be either periodically censused or threshold visual estimators be developed to ensure the program goals are achieved.

Eradication is impractical and impossible as a feasible alternative due to the size of St. John and the large number of inholdings. Therefore, efforts would focus on sustained control of the non-native rat, cat and mongoose populations and a concomitant reduction in their impacts on natural resources. To achieve this goal, a combination of techniques would be initiated in three phases. In the first phase, various techniques would be employed to reduce harborage and food resources for the present populations. In phase two, techniques would be used to quickly reduce populations to acceptable levels at sites such as Hawksnest, Trunk, Cinnamon, Francis, Saltpond and Lameshur bays, and Annaberg. Phase three would be to monitor and remove individuals that exceed threshold levels.

I.C.1. STEPS REQUIRED FOR SUSTAINED REDUCTION

PHASE I – Planning, Logistics, Consensus-Building, Food/Habitat Reduction

1. Prepare an Environmental Assessment for Non-native Rat, Cat and Mongoose Reduction.
2. Establish 1 – 3 human activity zones and tolerance limits for each zone and species.
3. Monitor food and trash (both food and non-food) handling and storage facilities, areas, practices, receptacles and schedules throughout the Park.
4. Inspect landscaping and buildings in high and medium human use zones with specific attention to non-native rat, mongoose and cat harborage, usage and access.
5. Develop a basic, comprehensive Non-native Rat Action Plan with Park food concessionaires.
6. Educate key NPS and concessionaire personnel about the Plan.

7. Implement measures to reduce harborage, food availability and food/building access by non-native rats, mongooses and cats (by a combination of methods):
 - a. Comprehensive inspections;
 - b. Mechanical rodent-proofing techniques;
 - c. Revise schedules to increase the frequency of trash pickup;
 - d. Curtail non-native cat feeding practices;
 - e. Retrofit all trash receptacles to exclude non-native rats, cats and mongooses; and
 - f. Improve food storage facilities.

PHASE II – Quick Population Reduction

After implementing Phase I, conduct large-scale direct reduction efforts to rapidly and substantially reduce non-native rat, non-native cat and non-native mongoose populations until acceptable population limits are achieved in cooperation with the U. S. Department of Agriculture's Animal Plant Health Inspection Service/ Wildlife Services Division.

For Norway and roof rats, Phase II consists of a single, large scale direct reduction using bait stations using diphacinone or baited live traps at such sites as Hawksnest, Trunk and Cinnamon bays with follow-up trapping/census to reduce populations to a level where they are no longer a significant problem. Rat populations would be monitored and maintained at acceptable levels with continued trapping and use of bait stations.

For domestic cats, Phase II consists of an initial, single, large scale direct reduction using live traps with efforts made to assist local animal care groups (e.g. St. John Animal Welfare Center) in placing the non-native cats for adoption. Follow-up census/trapping efforts would attempt to remove approximately 100% of the 30-50 existing non-native cats at such sites as Trunk, Cinnamon and Francis bays and Annaberg. Initially, efforts would be made with local citizen groups to remove friendly cats from existing feeding stations. Traps would be checked at no greater than 6-hour intervals so that cats are subjected to the least possible stress. The Park would work with local veterinarians prior to trapping to ensure that animal tags are available to the public so they can personally identify their cat as having a home so that the trapped animal can be returned to the owner.

For mongooses, Phase II consists of a single, large scale direct reduction using live traps baited with chicken or sardines, and follow-up census/trapping to reduce populations to a level where they are no longer a significant problem. This would be done at such sites as Hawksnest, Trunk, Cinnamon and Francis bays.

PHASE III – Monitor the Sustained Reduction

1. Monitor non-native rat, cat and mongoose populations, harborage, food availability, trash collection schedules, etc. regularly, using checklists. Keep records.
2. Maintain monitoring logs, continue routine building inspections, continue successful landscaping practices, and maintain comprehensive and accurate records.
3. Work effectively and cooperatively with partners including concessionaires, residents and visitors. Develop an educational campaign.

The timeframe for implementing each phase of the sustained reduction program would be: Phase I and Phase II concurrent for the next twelve months starting in November or December, 2001; and Phase III would monitor and remove individuals that exceed threshold levels indefinitely.

CHAPTER II: ALTERNATIVES

The National Environmental Policy Act (NEPA) requires that a reasonable range of alternatives be developed to provide decision-makers and the public with a clear basis for choice (*40 CFR 1502.14*). Case law has determined that reasonable alternatives include those that are technically and economically practicable and feasible, using common sense, rather than those that are simply desirable (*46 CFR 18027, Forty Most Asked Questions Concerning CEQ's NEPA Regulations*).

The alternatives detailed below were developed to focus on issues identified by NPS resource specialists NPS, rat and mongoose reduction experts and other control experts, government regulatory agencies, and the general public. Chapter VI, Consultation and Coordination list all individuals, agencies and organizations that provided substantive comments regarding the proposed actions.

This chapter describes six alternatives that are analyzed for control of non-native rat, cat and mongoose populations in Virgin Islands National Park. Following a brief description of control techniques for each species, two alternatives each are described for rat control (1) no action and (2) the proposed action; for cat control (3) no action and (4) the proposed action; and for mongoose control (5) no action and (6) the proposed action.

As required by NEPA, Alternatives 1, 3 and 5 are included as a “No Action” alternatives, serving as benchmarks against which other action alternatives can be compared. These alternatives represent the state of the management of these non-native wildlife populations within Virgin Islands National Park at this point in time.

II.A. Non-native Rat Control Alternatives

II.A.1. Non-native Rat Control Techniques

This section describes the primary mechanical and chemical techniques for an extensive and rapid population reduction effort for non-native rats.

Mechanical Live Trap and Euthanization

Captured animals must be killed because to relocate them would only transfer the problem elsewhere. This section describes various methodologies to capture and euthanize non-native rats. Extensive live traps are placed along designated trap lines (transects) and baited with fish flavorizer. Measures are taken to reduce nontarget captures of hermit crabs, birds, etc. (i.e. elevation of baits, bait site selection, etc. as necessary). Numerous kill traps are available and many are species-specific, greatly reducing capture of non-target species. Captured animals generally do not eat the bait once in the trap. If water is added to the trap, it is usually spilled by the captured animal, which becomes very animated for brief periods before settling down. When USDA/APHIS Wildlife Services Division field personnel arrive, the animal endures some trauma when being prepared for euthanization. The field personnel would bury euthanized rats caught in public use areas of the Park.

Sodium pentobarbital is an excellent central nervous system agent. Once properly injected with a small amount (average 2 cc/adult) in the heart, the animal falls into a deep sleep within 1 – 2 minutes and is

dead within 5 minutes. The drawbacks include stress on the animal, increased field time and high drug costs.

A “squeeze box” can be used to hold an animal for purposes of administering an injection. Because wild, aggressive omnivores cannot be safely placed into a “squeeze box” without first muzzling them, the animal must receive the injection while inside the live trap. This requires opening the cage door and quickly inserting a large cushion and pressing the animal and particularly its’ sternum, into the cage floor. When properly positioned, the heart is readily exposed for the lethal injection.

Another injecting alternative involves use of a “jab stick;” which consists of a syringe mounted to the end of a small pole. Jab sticks are principally used to apply intramuscular injections and would be impractical for an intracardiac injection. Other problems are the increased stress their use causes the animal, problems injecting the desired location and insufficient dosage. In addition, the animal often moves when the injection is taking places that can produce unnecessary injury.

Other means of destroying animals captured in live traps include drowning, clubbing, shooting, gassing and suffocation. Drowning is considered inhumane because of the suffering caused before expiration, and presents the problem of trap degradation. Clubbing is also considered inhumane and may allow maimed animals to escape. Gas poisoning is problematic and inhumane because of the time requirement, which may require up to 20 minutes, depending on the effectiveness of the apparatus. Suffocation is also inhumane, time intensive and requires additional handling. Shooting remains the most humane, expedient and cost effective treatment to dispatch a live-trapped animal, however, problems exist with shooting a small animal and containing the projectile.

Bait Stations

Bait stations would be distributed over the grid spaced at 50-foot intervals near picnic areas, campgrounds and concessionaire areas, and 150-foot intervals near the shoreline and in the Park’s upland areas. A pattern of trails would be established for bait placement and maintenance. Trails which would be cut for upland bait-lines would be roped off and marked with “Trail Closed Signs” to caution visitors and residents from walking off the hiking trail and onto the bait-lines. Trails would be hand cut with machete, but only the necessary amount of vegetation would be cut to allow for the passage of one person.

Baits would be placed in bait stations. Bait stations would be placed in trees or on the ground, and each station affixed to that location with cable ties, wires or stakes. This would prevent bait stations from moving either in high winds or heavy rains, and reduce any chance that a curious visitor could remove it. The stations are closed and locked so that a small child cannot access the bait. All bait stations would be numbered sequentially and labeled “NPS Rat Program - Do Not Touch” in both English and Spanish “along with other labeling as might be required by the registration.”

Once initiated, the baiting operation would require a minimum of 6 months to complete, with monitoring and maintenance for many years. Baiting would be the most intense during the dry season. After placement, baits will be checked and replaced as needed. Initially this would probably be every day for the first weeks, but would then drop to about once per week after the rat population is greatly reduced. Typically, baits are maintained for weeks after all consumption has virtually stopped to help assure that all rats have been eliminated (Witmer *et. al.* 1998)

Bait stations would be maintained and trap censuses conducted by USDA/APHIS Wildlife Services Division field personnel. Dead rats found in the public use areas of the Park would be recovered by the field personnel and buried in the ground.

Kill Traps

Numerous kill traps are available and many are species-specific, greatly reducing capture of nontarget species. Snap traps contained inside protective boxes have some applicability inside buildings after the population is reduced. The advantages include target (species) selectivity, immediate and humane death and lower labor costs. Some drawbacks include limits on trap placement, nontarget by-catch, maiming/escape potential, and evasion by trap-shy individuals.

Both live and kill traps can be easily modified to reduce incidental by-catch. Because rats are relatively small, their traps would also be small. In addition, if mice or mongooses were eliminated by a rat trap that would be beneficial as they are also species targeted for control. Improvisations to eliminate the capture of hermit crabs would be necessary (i.e. elevation of baits, bait site selection, etc. as necessary). Capture of other nontarget species is unlikely.

Chemical/Poison

Several types of rodenticides are available and have been successfully used for the management or eradication of commensal rodents. An anticoagulant type bait would be used because 1) they are effective in very low concentrations, 2) there is an antidote (vitamin K) to accidental poisoning, and 3) secondary hazards are lower than for more acute toxicants (Witmer 1998). Most rodenticides are registered for use in or within 150 feet of man-made structures. Use of rodenticides at Virgin Islands National Park would require authorization through a Section 24c of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The numerous existing toxicants would not be described in this document, in part because data are insufficient to support FIFRA registration. Thus, it is unrealistic to consider use of any other rodenticide for this program.

Several chemicals were considered for use including brodifacoum and zinc phosphate, but diphacinone (J. T. Eaton's Bait Blocks Rodenticide, EPA Reg. No. HI-970007 – Appendix C) was selected due to the considerable existing data to support registration, its excellent record in other similar control programs, and low hazards to non-target species compared to more acute toxicants (Conry 1994). Diphacinone has been used extensively for rodent control since the 1960's and for several years in other island situations. There have been no reported cases of secondary poisoning for raptors and only a few cases of poisonings in mammals. Diphacinone also has proven to be an excellent choice for mongoose control, an additional goal of this program.

The only non-target species we can determine that might have significant exposure to bait is the hermit crab. Dr. Earl Campbell with the USDA APHIS National Wildlife Research Center and other researchers familiar with this use pattern reported the concern is primarily one of baiting efficiency and not non-target hazards, as apparently the diaphacione has no effect on the crabs due to different blood composition (Campbell 1989). Efforts will be made to monitor and minimize this concern (i.e. elevation of baits, bait site selection, etc as necessary). There are no listed species present expected to eat baits or dead rats or dead mongooses.

Diphacinone has been used extensively and effectively for rodent control since the 1960's. Diphacinone is an anticoagulant that depresses the synthesis of prothrombin, an essential clotting factor. Buck Island Reef National Monument in St. Croix, U.S. Virgin Islands (NPS Buck Island Reef NM 1999) researched methods to eradicate non-native rats from the Monument. In 1999, they were granted a Section 24c under FIFRA, in cooperation with the Territorial Government of the U.S. Virgin Islands, to administer diphacinone (Eaton's Bait Blocks Rodenticide with Fish Flavorizer).

For a non-target species to be at risk of hemorrhaging, it would have to consume a minimum amount of the anticoagulant. Before any symptoms of anticoagulant poisoning are measured, a threshold level (concentration in the liver) must be reached. Symptoms include, but are not limited to, increased time to clotting (prothrombin times (PT)) leading to hemorrhaging. A minimum amount of active ingredient needs to be consumed, absorbed and bound in the liver, and significantly decrease the production of active clotting factors resulting in an increased prothrombin time, before an individual is considered at risk of hemorrhaging. Thus, organisms are able to tolerate sub-lethal levels of anticoagulants without displaying any symptoms of poisoning. Thus, all animals are able to tolerate some level of anticoagulant rodenticide exposure without risk of hemorrhaging. The level of risk is determined by the toxicity of the chemical and that individual's exposure. This analysis will focus on the potential primary and secondary poisoning risks to the wildlife resources.

Secondary toxicity would require a predator to eat several poisoned prey before reaching the threshold level to produce hemorrhaging. All the species of herptofauna living on St. John are primarily insectivorous and are at a low risk of exposure to these rodenticides; the use of bait stations would exclude most individuals from exposure. The pelagic and roosting seabirds are considered to be at a low risk of primary poisoning because their foraging strategy is almost exclusively offshore. They are almost exclusively carnivorous, preferring live marine prey. Brown Pelicans are not scavengers and will not eat dead and poisoned rodents. The use of bait stations would exclude most of the landbirds that are either granivorous or omnivorous from primary exposure risks. Although there are incidences of poisoning in most island eradications, some impacted species recovered to population densities that were higher than densities before rodenticide application due to removal of predators (Empson and Miskelly 1999; Robertson *et. al.* 1999). Some birds of prey, such as Red-tailed Hawk and American Kestrel, and scavengers are not at risk of secondary exposure through predation/scavenging of live /dead mice and rats containing rodenticide residues because field personnel would routinely recover dead rats and mice and bury them in the ground during all control operations. Birds of prey eat only living animals, while poisoned rodents would die in their burrows and thus be out-of-sight for any potential scavenging of rodents killed by poison. Therefore, it would be an extremely remote possibility that any birds of prey would ever locate and consume enough poisoned rodents to produce hemorrhaging.

Biological Control (Biocontrol)

Biological controls are inappropriate in this situation. Biocontrol is the use of species-specific control agents, typically pathogens or arthropods from the host's range, to provide effective control of a target pest.

II.A.2. Alternative 1. No Action

Under the No Action alternative, non-native Norway and roof rats would continue to flourish essentially unabated throughout Virgin Islands National Park. The terrestrial habitat would continue to decline under their foraging and predatory activities. Species protected under the Endangered Species Act would continue to be adversely affected, as non-native rats would continue to depredate endangered sea turtles, Brown Pelicans and Least Terns. Non-native rats would also continue to adversely impact visitor services and experience at concessions throughout the Park. There would be no use of rodenticides, except for the continued localized baiting in Park buildings. With no rodenticide application, the non-native rat population would not be controlled, and the number of rats on the island would fluctuate within the annual cycle.

Under the No Action alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas and collect trash on a regular basis. During the last year, Virgin Islands NP purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

II.A.3. Alternative 2. Proposed Action – Sustained Reduction

Under Alternative 2, the Proposed Action, the National Park Service, in cooperation with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division would conduct a site-specific non-native rat population reduction program using a combination of trapping or rodenticide applications within Virgin Islands National Park. The goal would be to reduce the non-native rat population in Virgin Islands National Park and to sustain a reduced population. The proposed action to accomplish this goal consists of a three-phase approach:

Phase I – Planning, Logistics, Consensus-Building

Essential elements of Phase I include the development of a basic Non-native Rat Action Plan with NPS concession operators and educating them and key NPS staff in implementing the plan using an Integrated Pest Management approach. This can only be accomplished through consensus-building efforts from each group or partner involved. In addition, reductions in food, harborage and building access are essential early steps.

A comprehensive inspection of every concession and NPS building by trained personnel and the application of mechanical rodent proofing techniques to restrict access are necessary. The surrounding areas would be inspected and treated with approved landscaping alterations aimed at reducing rat harborage. Trash collection procedures including storage practices and removal schedules would be reviewed and revised such that a minimal amount of available food would be present during the majority of the time. Particular emphasis would be placed on ensuring that virtually no food is accessible at night and especially outside. Trash receptacles would be retrofitted to be inaccessible to non-native rats, cats or mongooses (or burros).

Phase II – Quick Reduction

For non-native Norway and roof rats, Phase II consists of a single, large scale direct reduction using bait stations using diphacinone or baited live traps at such sites as Hawksnest, Trunk and Cinnamon bays with follow-up trapping/census to reduce populations to a level where they are no longer a significant problem. Rat populations would be monitored and maintained at acceptable levels with continued trapping and use of bait stations.

Phase III – Monitoring A Sustained Reduction

Phase III is the ongoing monitoring and record-keeping portion essential to maintain the goal to sustain the reduction. The consensus building efforts that were necessary to accomplish Phase I must be ongoing,

as new people become involved and others leave. Work effectively and cooperatively with partners including concessionaires, residents and visitors. Develop an educational campaign.

II.B. Non-native Cat Control Alternatives

II.B.1. Non-native Cat Control Techniques

This section describes the available techniques for non-native domestic cat control. Non-native cat control methods are outlined below. Remedies such as crack and crevice treatment, landscaping changes and others are discussed elsewhere on Pages 12 and 13. Please refer to II.A.1. Non-native Rat Control Techniques, for a more thorough description of the mechanical and chemical information that applies equally to non-native cats. This section describes methods for an extensive and rapid population reduction effort for non-native cats.

The following additional control techniques are presented here for non-native domestic cats.

Trap-Test-Alter-Vaccinate and Release (TTAVR) Programs

Non-native domestic cat populations pose problems for native fauna worldwide. In areas where eradication is unfeasible, the TTAVR system is one alternative (Patronek 1997). TTAVR programs have become more common in urban settings, especially in affluent communities of large metropolitan cities and less common in rural areas. Few studies have been conducted to compare TTAVR with other alternatives. The program is designed to trap 100% of the animals, test for disease, surgically sterilize and release disease-free animals. Diseased animals are chemically euthanized. The released cats are maintained in carefully supervised colonies, where the ultimate goal is colony elimination through attrition.

Few TTAVR programs have been carried out in rural areas with several cat colonies, and none reported colony elimination. The major problems are new introductions, trap-shy individuals and continued native fauna depredation even with adequate feeding. As noted elsewhere for mongooses, a mistaken or malicious abandonment of one pregnant cat can initiate the formation of an additional colony. Moreover, because supplemental feeding of treated cats is necessary to humanely conduct the program, many non-target species, including non-native rats and non-native mongooses, are also fed (Appendix D).

A recent study by Dan Castillo at the Department of Environmental Studies at Florida International University (2001), contradicts widely-held beliefs by cat colony proponents that well-fed cats do not kill wildlife, that cats are territorial and will prevent more cats from joining the colony, and that cat colonies decline in size over time.

Two cat colonies in Miami-Dade County parks were observed for 13 months and, contrary to previous assumptions, it was found that almost every month new cats joined the colonies while other cats disappeared. The colonies acted as dumping grounds for unwanted cats, despite state and county laws making this illegal. Despite attempts by volunteers to have the cats spayed or neutered, intact cats were observed, as were pregnant cats and newborn kittens.

Although well fed, cats at both locations were observed chasing, stalking and killing birds and other animals. Aggressive interactions among the cats were few and did not limit cat access to food or the

colonies. Cat feeders placed large amounts of food throughout the parks that then attracted other animals such as raccoons, foxes, skunks and stray dogs.

According to Castillo, “Managed cat colonies are not the solution to cat overpopulation problems. My findings demonstrate that the establishment of cat colonies on public lands encourages cat abandonment and is harmful to native wildlife. Cat colonies do not decline over time – they just perpetuate themselves.”

Linda Winter, Director of Cats Indoors! for American Bird Conservancy, a non-profit conservation group, stated, “Mr. Castillo’s study confirms what other studies have shown – that cat colonies cannot be managed and do not belong in parks. Solutions to the stray cat overpopulation must also protect birds and other wildlife.”

Capture-Treat-Adopt Programs

Often used in the initial efforts to quickly reduce non-native domestic cat colonies from many areas humanely, albeit expensively, non-native cats are captured, tested and treated for disease and sterilized. Placement facilities then operate to disperse the animals into homes. When and if the adoption market saturates, the program must be discontinued. One problem with this method is that most non-native cats are not easily domesticated and few people want to attempt to tame a wild cat.

Keep Cats Indoors Programs

To prevent cats from becoming predators and harming wildlife, the NPS would work closely with local landholders and communities in an effort to stem the flow of non-native domestic cats into the Park by promoting responsible cat ownership. NPS would support programs to neuter or spray cats before reaching reproductive age, register cats, and encourage owners to keep their cats indoors; and do not release unwanted animals in Park natural areas. NPS would work with the scientific, conservation and animal welfare communities to educate the public about the dangers that free-roaming cats pose to human health, birds and other native wildlife and the hazards to free-roaming cats.

Outdoor domestic cats, even otherwise well cared for cats, face an extraordinary array of dangers. According to the Humane Society of the United States, free-roaming cats typically live less than five years, whereas cats exclusively kept indoors often live to 17 or more years of age. The American Bird Conservancy’s Cats Indoors! Campaign is supported by thousands of individuals and organizations in the conservation, animal welfare, wildlife rehabilitation, and veterinary communities (The Wildlife Society, Number 307, 2001).

Unaltered outdoor cats are the major source of the cat overpopulation problem, causing millions of unwanted cats to be euthanized at animal shelters each year. Humane Societies and animal care and control agencies struggle to rescue, treat, feed, and house stray and unwanted cats. Kittens can be safely spayed or neutered as early as eight weeks of age, and there are significant physical and behavioral benefits of this procedure. Without the biological urge to roam to find a mate, spayed or neutered cats live more contentedly indoors.

II.B.2. Alternative 3. No Action

Under the No Action alternative, non-native cat prides would exist unabated throughout Virgin Islands National Park. The terrestrial habitat would continue to decline under their foraging and predatory

activities as non-native cats would continue to depredate Brown Pelicans and Least Terns and sea turtle hatchlings.

The no action alternative would result in occasional non-native cat removal efforts by Park and concessions personnel as a stopgap measure when local populations become excessively large. Simultaneously, employees of the Park, concessionaires, locals and visitors, would continue periodic feeding throughout the Park. Some locations have been the target of organized feeding efforts for several years. These areas include Annaberg and Francis, Maho, Cinnamon, Trunk, Hawksnest, Caneel, Saltpond and Lameshur bays. Cats would continue to be regularly abandoned in the Park.

Under the No Action alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas. During the last year, Virgin Islands NP has purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

II.B.3. Alternative 4. Proposed Action – Sustained Reduction

Under Alternative 4, the Proposed Action, the National Park Service, in cooperation with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division would conduct a site-specific non-native domestic cat population reduction program using trapping within Virgin Islands National Park. The goal would be to reduce the non-native cat population to zero or near zero throughout the Park. The proposed action to accomplish this goal consists of a three-phase approach:

Phase I – Planning, Consensus-Building & Education

Essential elements of Phase I include the development of a basic Non-native Domestic Cat Action Plan with NPS concession operators and to educate them and key NPS staff in implementing the plan using an Integrated Pest Management approach. This is accomplished through consensus-building efforts with each concerned group or partner. Particular support would be solicited from the St. John Animal Welfare Center and The St. Thomas Humane Society to develop and implement corrective information on a continuous basis.

To prevent cats from becoming predators and harming wildlife, the NPS would work closely with local landholders and communities in an effort to stem the flow of non-native domestic cats into the Park by promoting responsible cat ownership. NPS would support programs to neuter or spray cats before reaching reproductive age, register cats, and encourage owners to keep their cats indoors; and do not release unwanted animals in Park natural areas. NPS would work with the scientific, conservation and animal welfare communities to educate the public about the dangers that free-roaming cats pose to human health, birds and other native wildlife and the hazards to free-roaming cats.

Trash collection procedures, including storage practices and removal schedules that were revised for non-

native rats would assist with non-native cat reduction efforts. Trash receptacles allowing non-native rats, cats or mongooses would be retrofitted to exclude them.

Phase II – Quick Population Reduction

Phase II consists of an initial, single, large scale direct reduction using live traps with efforts made to assist local animal care groups (e.g. St. John Animal Welfare Center) in placing the cats for adoption. Follow-up census/trapping efforts would attempt to remove approximately 100% of the 30-50 existing non-native domestic cats at such sites as Trunk, Cinnamon and Francis bays and Annaberg. Initially, efforts would be made with local citizen groups to have captured animals tested, sterilized and placed for adoption. Traps would be checked at no greater than 6-hour intervals so that cats are subjected to the least possible stress. The Park would work with local veterinarians prior to trapping to ensure that animal tags are available to the public so they can personally identify their cat as having a home so that the trapped animal can be returned to the owner.

Phase III – Monitoring the Sustained Reduction

Phase III is the ongoing monitoring and record-keeping portion essential to maintain the goal to sustain the reduction. The consensus building efforts that were necessary to accomplish Phase I must be ongoing, as key positions and personnel change. Work effectively and cooperatively with partners including concessionaires, residents and visitors. Develop an educational campaign.

II.C. Non-native Mongoose Control Alternatives

II.C.1. Non-native Mongoose Control Techniques

This section describes the primary mechanical and chemical methodologies for non-native mongoose control. Remedies such as crack and crevice treatment, landscaping changes and others are discussed elsewhere on Pages 12 and 13. Non-native mongoose control methods are outlined below and include: mechanical live trap and euthanization; kill traps; and chemical/poison. Please refer to II.A.1. Non-native Rat Control Techniques, for a more thorough description of the mechanical and chemical information applies equally to non-native mongooses.

This section describes methods for an extensive and rapid population reduction effort for non-native mongooses.

Mechanical Live Trap and Euthanization

Captured animals must be killed because to relocate them would only transfer the problem elsewhere. Extensive live traps are placed along designated trap lines (transects) and baited with diaphacione. Measures are taken to reduce non-target captures of crabs, birds, etc. Numerous kill traps are available and many are species-specific, greatly reducing capture of non-target species. Sodium pentobarbital is an excellent central nervous system agent that will be used for euthanization. Once properly injected with a small amount (average 2 cc/adult) in the heart, the animal falls into a deep sleep within 1 – 2 minutes and dies within 5 minutes.

Kill and Live Traps

Numerous kill traps are available and many are species-specific, greatly reducing capture of non-target species. Both live and kill traps can be easily modified to reduce incidental by-catch.

Chemical/Poison

Sodium pentobarbital is an excellent central nervous system agent that will be used for management of carnivores, such as mongooses.

II.C.2. Alternative 5. No Action

Under the No Action alternative, non-native mongooses would continue to flourish essentially unabated throughout Virgin Islands National Park. The terrestrial habitat would continue to decline under their foraging and predatory activities as non-native mongooses would continue to depredate endangered sea turtles, Brown Pelicans and Least Terns (NPS Management Policies 2001, Chapter 4, Page 11). NPS would fail to comply with the NPS Organic Act (1916) requiring the protection of native flora and fauna for future generations. Non-native mongooses would also continue to adversely impact visitor services and experiences at concessions throughout the Park. There would be no use of rodenticides, except for the continued localized baiting in Park buildings. With no rodenticide application, the non-native mongoose population would not be controlled, and the number of mongoose on the island would fluctuate within the annual cycle.

Under the No Action alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas. During the last year, Virgin Islands NP has purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

II.C.3. Alternative 6. Proposed Action – Sustained Reduction

Under Alternative 6, the Proposed Action, the National Park Service, in cooperation with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division would conduct a site-specific non-native mongoose population reduction program using reduction using live traps baited with chicken or sardines within Virgin Islands National Park. The goal would be to reduce the non-native mongoose population to approximately 15% of the current population at key population centers throughout the Park. The proposed action to accomplish this goal consists of a three-phase approach:

Phase I – Planning, Consensus-Building & Education

Phase I Essential elements of Phase I include the development of a basic Non-native Mongoose Action

Plan with NPS concession operators and to educate them and key NPS staff in implementing the plan using an Integrated Pest Management approach. This is accomplished through consensus-building efforts with the concessionaires.

Trash collection procedures including storage practices and removal schedules that were revised for non-native rats would assist with non-native mongoose reduction efforts. Trash receptacles would be retrofitted to be inaccessible to non-native rats, non-native cats or non-native mongooses.

Phase II – Quick Population Reduction

For non-native mongooses, Phase II consists of a single, large scale direct reduction using live traps baited with chicken or sardines, and follow-up census/trapping to reduce populations to a level where they are no longer a significant problem. This would be done at such sites as Hawksnest, Trunk, Cinnamon and Francis bays.

Phase III – Monitoring the Sustained Reduction

Phase III is the ongoing monitoring and record-keeping portion essential to maintain the goal to sustain the reduction. The consensus building efforts that were necessary to accomplish Phase I must be ongoing, as key positions and personnel change. Work effectively and cooperatively with partners including concessionaires, residents and visitors. Develop an educational campaign.

III. CHAPTER III: AFFECTED ENVIRONMENT

III.A. NATURAL RESOURCES

This section of the Environmental Assessment describes the current status of baseline information from inventories, monitoring and research projects. NPS-77, "Standards for Natural Resource Inventory and Monitoring", and the *1997 Inventory and Monitoring Implementation Plan* by the Biological Resources Division, USGS were also used as sources of information. The description of the affected environment is not meant to a complete description of the program area. Rather, it is intended to portray the significant conditions and trends of the resources that may be affected by the proposed program or its alternatives.

Setting

Virgin Islands National Park is located near the Tropic of Cancer in a group of small islands known as the Lesser Antilles that separate the Caribbean Sea from the Atlantic Ocean. The most northwesterly of this clustered island chain are the Virgin Islands of the United States and Great Britain, and approximately 113 kilometers (70 miles) to the west, the U. S. Commonwealth of Puerto Rico. The U.S. Virgin Islands, made up of three main islands and 57 smaller, mostly uninhabited islands and cays, are found near the crossing of 18 degrees north latitude and 64.5 degrees west longitude. The island of St. John (52 square kilometers or 20 square miles) is the smallest and least developed of the three main U.S. owned Virgin Islands. St. Croix (218 square kilometers or 84 square miles) lies approximately 64 kilometers (40 miles) to the south of St. John, and St. Thomas (83 square kilometers or 32 square miles), lies about 4 kilometers (2.5 miles) to the west.

Virgin Islands National Park comprises over half (2,816 hectares or approximately 10 square miles) of the island of St. John. Established in 1956, the Park was expanded in 1962 to encompass 2,287 hectares (8.7 square miles) of the surrounding waters. Of the NPS land on St. John, either private interests or the Virgin Islands government owns three square miles. In 1978, Congress authorized the addition of approximately 135 acres on Hassel Island in the Charlotte Amalie Harbor, St. Thomas to the Park. The NPS has acquired most of the land on Hassel Island and has limited first right to match any offers on most of the remaining private properties. The Virgin Islands government also owns lands on Hassel Island. Also, on St. Thomas, approximately 15 acres in the Red Hook area are under Park jurisdiction and, until recently, served as the Park's administrative headquarters.

Because of its internationally significant natural resources, Virgin Islands National Park was designated an international biosphere reserve in 1976 and is one of the few biosphere reserves that has both marine and terrestrial resources. The Park was included in the United Nation's Biosphere Reserve System as a representative example of Lesser Antillean cultural and natural ecosystems.

Virgin Islands National Park contains examples of most tropical Atlantic terrestrial, coastal and marine ecosystems. These include various examples of subtropical dry to moist forest, salt ponds, beaches, mangroves, seagrass beds, corral reefs and algal plains. Terrestrial topography is quite dramatic with average slopes being 30 percent. The highest mountain peak plunges sharply to the sea over a distance of three-quarters of a mile. Rock petroglyphs, middens and three settlements are several of the remains of prehistoric cultures found to date. European settlement patterns and plantations systems significantly altered St. John's biology and ecology by removing native forests, building structures, terraces, rock walls and roads, and importing vegetation and mammals. The plantation settlements took advantage of the labor of African slaves. The last four decades have brought considerable change on St. John through the development of vehicular transportation and roads, resorts, and other tourist facilities.

In terms of visitor attractions, scenery and beaches are probably the most significant features of Virgin Islands National Park. However, there are about 250 historic structures within the Park, most of them remnants of the Danish sugar plantation era, which are increasingly popular with tourists. Over the past ten years, visitation to the Park has averaged approximately 942,800 persons annually.

Terrestrial Vegetation

Large portions of the original forests of St. John were cleared for plantations during the late 1700s and early 1800s. Many, if not most, of the tropical hardwood trees found here were harvested and sent to Europe for furniture, boat and mast construction. This intensive modification of the forest distribution and structure changed the hydrologic regime that was present on St. John. The island became drier as vegetative cover was removed or modified. Evidence from relict streambeds indicates that St. John may have had perennial streams that are no longer in existence. Ultimately, forest destruction has affected over 90% of the island. The present vegetation exhibits differing degrees of revegetation, ranging from recently disturbed to late-secondary successional forests, which may be as old as 100 years. Eleven vegetation types have been mapped, including: mangroves, salt flats, pasture, upland moist forest, gallery moist forest, basin moist forest, dry evergreen forest, dry thicket and scrub, thorn and cactus, disturbed vegetation, and rock and coastal hedge. About 63% of the island is in the dry evergreen forest category and 17% in the combined moist forest category. The upland moist forest contains some virgin stands with minimal exotic floral species. The tallest trees on the island grow along the banks of the intermittent streambeds.

Presently, the greatest threats to forest regeneration are development and growing populations of non-native hogs, goats and donkeys. Goats and donkeys alter forest composition by selectively feeding on palatable species and distributing the seeds of exotic species through their feces. Hogs destroy vegetation through rooting up of plants. Despite disturbance by non-native animals and construction, Park lands continue to be a valuable refuge for native plant species. To date, 747 species of vascular plants have been identified from St. John, of which 642 (86%) are native to the island. The species are found in 117 families, of which 12 are introduced. Almost all species (99.7%) on St. John are found on other islands within the Virgin Islands. Two species are endemic to St. John (*Eugenia earhartii* and *Machaonia woodburyana*) and six others are endemic to the Virgin Islands. Another 25 species are endemic to the Puerto Rico platform. Many voucher specimens and representatives of common plants have been collected by premier botanists and placed in the Park herbarium collection, creating an extensive collection of most species on the island. As they conduct monitoring and inventories, botanists continue to identify new species. For example, Pedro Acevedo-Rodriguez of the Smithsonian Institute discovered three species new to St. John in 1992.

Native Animals

The only mammal native to St. John is the bat. Three of the six native species of bats are protected under the V.I. Endangered and Indigenous Species Act of 1990 (Act No. 5665). Some bat species are important pollinators of many floral species on the island as well as important seed dispersal agents for many species of fruit bearing trees and shrubs. Other species of bats consume vast quantities of insects, including mosquitoes. Fish-eating bats are also present. It has been noted that bat abundance at night on St. John may exceed bird abundance during the day. Except for a short study using ultrasonic surveys to detect bats, little is known of bat abundance, locations of roosting maternity colonies or threats to bats on St. John.

Recent museum analysis of materials excavated from the Cinnamon Bay archeological dig during 1998 has yielded some startling discoveries. The remains of at least four extinct animals have been identified, including the Caribbean Monk Seal (*Monachus tropicalis*), Puerto Rican Shrew (*Nesophontes*, sp.), a flightless rail and others. At least six other species have been identified which have been extirpated from

the Virgin Islands. This dig has revealed considerable information about faunal assemblages on St. John before European colonization and demonstrating that the Taino Indians lived a very different natural world from what we find today. These animals were apparently important food sources for these Native American Indians. These Indians may have brought some species such as the Green Iguana (*Iguana iguana*) and the Red-Foot Tortoise (*Geochelonia carbonaria*) to the Virgin Islands from South America as food sources.

Avifaunas are abundant and varied. The latest National Park Checklist of Birds on St. John includes 170 species in 17 families. St. John is a major overwintering area for migratory warblers using the eastern flyway. Fragmentation of habitat has been suggested for reducing populations of over-wintering warblers. More recent research from 62 permanently marked survey points in moist forest and dry woodland on St. John suggests that the reduction in numbers of overwintering warblers is due primarily to reduced numbers of one species (Northern Parula) and possible reductions in breeding populations along the southeastern United States from North Carolina to northern Florida. Birds are probably the best-studied group of animals in the Park. Continued surveys are necessary to determine trends in populations of resident and migratory species.

The terrestrial reptiles and amphibians on St. John are quite varied. There are three native species of Tree Frogs (*Eleutherodactylus lentus*, *E. antillensis* and *E. cochranae*) and one introduced species, the Cuban Tree Frog (*Osteopilus septentrionalis*), one introduced Marine Toad (*Bufo marinus*), two Geckos (*Hemidactylus mabouia* and *Sphaerodactylus macrolepis*), three species of Anolis Lizards (*Anolis stratulus*, *A. cristatellus* and *A. pulchellus*), the Red-foot Tortoise (introduced), Green Iguana (introduced), Ground Lizard (*Ameiva exsul*), Legless Lizard (*Amphisbaena fenestrata*), Worm or Blind Snake (*Typhlops richardii*), a type of Garter Snake (*Arrhyton exiguus*), the Puerto Rican Racer (*Alsophis portoricensis*) and the Slipperyback Skink (*Mabuya mabouya*). Herpetological populations on St. John have not been adequately inventoried or monitored. Species that occur on nearby islands may also occur here but have not been observed and documented.

Catherine Curry made a checklist from insect species in the Park museum collection in 1970 when ten families were represented and 52 species identified (Curry 1970). William Muchmore (1987) studied terrestrial invertebrates in 1987 and made a collection of common representative insects for the Park. Two hundred and thirty-two species representing 124 families were identified. Arachnida (scorpions, pseudoscorpions, harvestmen, and spiders) made up the largest order. Jeremiah Trimble has identified thirteen species of dragonflies and damselflies (Order Odonata) in VINP (Trimble J., IAR, 1997). Michael Ivie (1983 and 1984) has been studying beetles (Coleoptera) in the Virgin Islands for several years. Before he started, approximately 75 species of beetles had been described for the VI. He has now documented over 1500 species (several new species) and expects to find over 2000. Most of these species may be found in VINP, but will only be documented through further studies. Additional inventories covering a greater number of families are needed to more fully document the species and distributions of insects within VINP.

Endangered/Threatened Species

The Endangered Species Act (PL 93-205) requires that federal agencies protect all listed species and habitats. Twelve federally listed endangered and threatened species have been observed in the Park. Five species of whales, as well as several porpoise species, may migrate through the Park. The endangered West Indian Manatee had been recorded as being very rare around St. John, although it has been recently recorded (ca. 1990) from West End, Tortola. These listed species, which include six marine mammals, five birds, three reptiles (sea turtles) and two plants.

Five federally listed threatened or endangered bird species have been identified. The federally endangered Brown Pelican nests, feeds and roosts both adjacent to and within National Park boundaries. The U.S. Fish and Wildlife Service is evaluating nesting success in considering this species for delisting. The federally endangered Peregrine Falcon is a rare winter migrant. The federally threatened Roseate Tern and endangered Least Tern are summer residents that have both been observed nesting within the Park in recent years (1997 and 1999, respectively). Piping Plover are a very rare summer migrant.

Two of the federally listed sea turtles are commonly found in Park waters. The Hawksbill Sea Turtle requires coral reefs for food and refuge. Peak nesting season on Park beaches is from July through November, although nesting activity may take place any month of the year. While Green Sea Turtles feed in seagrass beds in Park waters, they are infrequent nesters on St. John beaches.

The federally endangered Virgin Islands Tree Boa (*Epicrates*) has never been observed on St. John although it occurs on the east end of St. Thomas and on Tortola, BVI. This species could conceivably exist on St. John.

All federally and territorially listed species require some level of protection and monitoring. Direct impacts on federal endangered species by non-native species include the rooting of *C. thomasi* by non-native hogs and depredation of sea turtle nests and eggs by the small West Indian Mongoose (*Herpestes auropunctatus*). Non-native goats and donkeys may be having an impact on many territorial endangered species of plants. Sea turtles are periodically struck and killed by boats speeding through Park waters. Nesting frequencies have decreased on many beaches due to adjacent upland development that results in people, lights and dogs, all of which deter turtles from using particular beaches.

While considerable information exists on seasonality of nesting for sea turtles using VINP beaches, no rigorous studies of nesting numbers and frequencies on all VINP beaches has been carried out since the early 1980's. While the distribution of endangered plants is relatively well known, the extent of threats to the species is speculative.

Introduced Animals and Plants

With the exception of bats, the VINP is presently inhabited by numerous species of non-native mammals that have produced severe impacts on many indigenous species of plants and animals and threats to visitor safety. Non-native mammals include the white-tail deer, donkey, hogs, goats, cows, European boar, Indian mongoose, rats and cats. With the possible exception of the deer, increasing populations of these species are seriously affecting native species of plants and animals. Hogs and European boar are seriously threatening the sole, small remaining populations of the endangered St. Thomas Lidflower (*Calyptanthus thomasi*) and *Solanum conocarpum*, which has been proposed for listing. Cats have and continue to threaten populations of reptiles and ground and shrub nesting birds as well as providing vectors for transmission of parasites and diseases to humans. Mongoose have devastated reptile populations, some bird populations and continue to depredate the nests of the endangered hawksbill sea turtle (Coblentz, 1983). Donkeys destabilize steep slopes through maintenance of trails and this results in erosion and impact to coral reefs and seagrass beds. They also affect plant community composition, distribution and succession through selective feeding and dispersal of exotic plant species. Goatherds are capable of denuding large areas of land of all vegetation, including trees (through bark stripping) and cactus. The VINP represents possibly the largest and best example of dry tropical forest remaining in the Caribbean and many of these exotic species are having a serious impact on its health and sustainability.

Some of these species also threaten visitor experience and safety. Donkeys continue to enter campsites and destroy tents and camping equipment in their efforts to locate food items. Visitors have been bitten and threatened by some donkeys. Traffic safety becomes an issue when visitors stop to look at or

photograph donkeys on the road, thus impeding traffic and causing accidents. Diseases (“creeping eruption”) that have been transmitted by cats have recently affected numerous visitors.

While many of the introduced species are recognized as having on our indigenous species of plants and animals, these impacts have never been quantified. Quantification would enable NPS to realistically prioritize species in terms of threats and guide us in the development of management measures to address the threats.

III.B. NATURAL RESOURCE THREATS

This section of the Environmental Assessment summarizes the condition of the natural resources. It addresses the nature and severity of major threats to the natural resources and impacts that have the potential to degrade those resources.

Land Use and Boundary Issues

Approximately 56.7% of the island is federal land. The Park owns 2939 hectares (7,259 acres) of the 3840 hectares (9,485 acres) authorized by the enabling legislation. Within the Park boundary, 26.5% (901 hectares or 2,226 acres) of the land is owned by either private interests or the Virgin Islands government. These separate parcels of non-federal land or “inholdings” are dispersed throughout the federal land within the authorized boundaries. The trend has been to further sub-divide the parcels and develop them. There were 261 parcels of non-federal land in 1991 and approximately 322 in 1992.

There are currently no NPS restrictions on the type of development that can occur on non-federal. Local zoning or Coastal Zone Management Act (CZM) protection has often been inadequate because it may not be rigidly enforced and therefore circumvented. Virgin Islands National Park participates in CZM or any permit review for construction or modification of land within or adjacent to Park boundaries. The Resource Management Division has established mechanisms for the Park to be contacted on adjacent development issues and to participate in the review/permitting process. There is also a need to upgrade the Park's land status maps (1986) to show changes in ownership and watch for potential development. Due to lack of eminent domain authority, the Park has to compete for NPS acquisition funds and/or must work closely with groups like the Friends of Virgin Islands National Park and Trust for Public Lands who can either purchase land and hold it until Park funds are available or purchase and donate land to the Park.

Development of private inholdings and land adjacent to the Park boundary and pressure to re-open and/or pave old Danish cart roads within the Park represents a serious threat to marine and terrestrial ecosystems in the Park. Clearing of St. John's steep hillsides on slopes approaching and exceeding 30 degrees has resulted in elimination of native species, spread of exotic plants and non-native wildlife, increased soil erosion, loss of sparse topsoil, and fragmentation of the forest and “viewsheds”. These impacts need to be minimized or at least mitigated. Because development cannot be prevented, eco-sensitive development must be encouraged to require use of recycled and low energy products as well as forested scenic easements. Agreements with landowners could be developed to achieve energy savings, and to minimize loss of biological diversity, introduction of exotic species, degradation of Park resources and scenic values.

Intact forests are important habitat for migratory birds. Development of private lands within the Park and construction of roads through watersheds which are now largely undisturbed could have adverse consequences for the birds which winter in the Virgin Islands.

Visitation Issues

Visitation to the Park by individuals is usually of a short-term nature. The annual number of visitors has increased from around 120,000 in the early 1970's to over one million. Heaviest visitor use occurs between November and May, and Wednesday through Friday, reflecting cruise ship arrivals. Most visitors spend their time on, in or near the water. Beach use and boating are the most popular activities. The beaches along the northwest shore between Cruz Bay and Cinnamon Bay receive the highest concentration of use. Many tours are also taken to the cultural site, Annaberg Plantation.

It is desirable to provide a variety of opportunities for visitors, from concession operated/heavy use to primitive surroundings/light use. Tourist influx to the Park continues to increase. Human carrying capacities were established in the 1983 GMP for Park facilities, anchorages, recreational beaches and Biosphere Reserve core areas and human impacts to resources were reduced in creative ways. These carrying capacities need to be reevaluated in light of the trends in visitation since 1983. Congestion and potential crowding threaten to impact not only the quality of the visitor experience but also the integrity of scenic, natural and cultural resources. The Final Commercial Services Plan/EA (2001) identifies desired future conditions that represents commercial use capacities which best balances resource protection with a quality visitor experience. Trails, roads and facilities must be maintained and upgraded, but not at the expense of the environment.

Starting in 1998, the Fee Demo Program instituted a fee collection program for Trunk Bay and Annaberg Plantation. Visitors now pay \$4.00 per person to visit both sites, whether by land or water. Of fees collected, the Park retains 80% and can submit proposals to compete for the remaining 20%. In the first years of this program, substantial funds have been collected for use in upgrading visitor facilities and providing enhanced services, such as animal-proofing many trash receptacles and dumpsters.

Threats to Endangered and Threatened Species

Protection of threatened and endangered species and their habitat is imperative, as is reduction or control of exotic and non-native species. Threatened and endangered species of plants are threatened by development of inholdings and damage caused by non-native animals. Rooting activities of wild hogs is damaging the *Calyptanthus* population on Bordeaux. Domestic goats and donkeys graze on seedlings and saplings of rare plants and disperse the seeds of non-native species that compete with the rare species for light and water.

Patrol rangers strictly enforce the pet leash and restriction laws, especially during turtle nesting season. Dogs must be kept on a leash or physically restrained while in the Park (36 CFR 2.15). Dogs must be kept off beaches in the Park where turtle nesting occurs. Dogs dig in the sand, sometimes finding the scent of a sea turtle nest and digging it up.

The major threat to the reproductive success of threatened and endangered sea turtles is predation of eggs and hatchlings by mongooses. Predation of sea turtle eggs by mongooses is a learned response. Mongooses see a dog or other mongoose digging a nest or find a recently dug nest and discover a high protein source of food. Although sea turtles attempt to disguise the scent by dispersing sand with their flippers, mongooses often detect it and dig to find the eggs. Mongoose predation accounted for up to a 23% loss of sea turtle eggs (Nellis & Small, 1983). Some beaches on St. Thomas experience 100% predation of eggs and nests. Since they are the major predators and threat to nesting success, trapping mongooses each season is necessary adjacent to nesting beaches.

Human poaching of threatened and endangered sea turtles and taking of eggs may be a problem in remote areas of the Park. Sea turtle products, mostly hawksbill shells, are the most commonly confiscated products by the U.S. Customs at United States borders. These confiscation's are on the increase. Taking

of adult turtles, mostly green, is still allowed in adjacent British waters. Public education, involvement of volunteers with beach patrol programs and encouraging protection of the endangered and threatened sea turtles in British waters, can raise community awareness about these ancient animals while reducing the incidence of taking and poaching.

Turtle mortality due to boat strikes has significantly increased over the last fifteen years (Boulon, 1997). In some years, over half of all reported turtle strandings involved damage to the carapace from boat propellers or hulls. Increasing populations of juvenile green turtles and increasing numbers of high speed powerboats results in increased numbers of incidental mortalities. The numbers of high speed boats travelling along the north shore of St. John en route to the BVI continues to increase.

While other parts of the world (SE U.S., Hawaii) have been reporting large numbers of green turtles affected with fibropapillomas, the USVI has only had a few reports of individuals having this disease. However, reports of infected turtles are on the increase and sizes of reported tumors are also increasing. This may become a great concern if this disease starts to affect a large segment of our turtle population. Monitoring of in-water sightings and strandings must be maintained.

Endangered and threatened seabirds (Brown Pelican, Roseate and Least Tern) are most commonly affected by predation on eggs and young by rats and mongoose. Humans are also potential poachers of eggs in remote areas. Disturbance by human visitation to offshore cays results in low egg production, death of chicks to sun exposure or even abandonment of the whole nesting colony. Decreases in baitfish populations may limit nesting populations and affect the breeding and fledging success of these birds.

Non-native/Exotic Animal Impacts

Donkeys, domestic goats and wild hogs graze and browse on vegetation both inside and out of the Park. Impacts to vegetation have been identified and recorded (Coblentz, 1983; Ray, 1990). Plants on St. John did not evolve with grazers and browsers so have not developed defenses and survival tactics. Forest structure and species composition is changing due to introduction of exotic plants in fecal matter and disappearance of favorite non-native animal foods. Domestic goats are predominantly concentrated along the east and southeast boundary of the Park. They are beginning to utilize Ram's Head, Annaberg and Brown Bay quite heavily. Hogs are centered around the Susannaberg landfill and have spread from there to Bordeaux Mountain. Signs of rutting are now found in Catherineberg, Reef Bay, Cinnamon Bay and Lameshur Bay. Donkeys wander the entire island. Young black mangrove saplings (a protected species) are one of their favorite foods.

Recent introductions include two species of frogs from Puerto Rico and a bird. The Cuban Tree Frog is thought to prey on species of smaller frogs such as our indigenous tree frogs. The "coqui" has been heard around Caneel Bay. The house sparrow flew across the narrow 3-mile wide channel separating St. Thomas and St. John and has been seen around Cruz Bay. Audubon Society members are monitoring this species and have attempted some reduction.

Non-native Norway and Tree Rat Impacts

Norway Rats (*Rattus norvegicus*) existed on St. John from the 1700's and were introduced by European explorers. Black or Tree Rats (*Rattus rattus*) existed on St. John from the earliest records and were possibly introduced by Taino Indians visiting from South America. Both species occur in Virgin Islands National Park and range throughout St. John, but the tree rat is considerably more common. Most problems arise from the nocturnal black rats, which reside in trees and generally forage only at night. Tree rats are associated largely with people and human establishments.

As commensal rodents, Norway and tree rats are habituated to living near humans and except for an occasional predation by red-tailed hawks, they have no biological predators. Rats are omnivorous; they eat nearly every kind of grain, fruit, fish, fowl, carrion, milk products, and vegetables. Several rodents can destroy hundreds of chicks in just one night.

Rats gnaw to keep their incisor teeth sharp and worn down, as these teeth grow over 5 inches a year. This gnawing causes considerable property damage. These rodents sometimes start fires when they damage the insulation of electrical wiring. They may also use flammable materials like oily rags and matches for building nests, which may cause fires from spontaneous combustion. Extensive damage is sometimes done when rats burrow under buildings. Foundations and lower floors of buildings have been weakened and some have collapsed when rats burrowed under them.

Large rat populations can only exist if sufficient food is available. Therefore, when the food supply is reduced, the population will fall. Increased sanitation, more frequent trash pick-up, rodent-proofed trash receptacles, and enhanced food preparation and storage practices can easily reduce the available food. These changes should be well established before a large-scale population effort is initiated (Erickson 1987, Erickson and Halvorson 1990).

During dry periods, rats become more aggressive when their need for water increases. Also, when more food becomes available their numbers increase dramatically in a short time. Basic education, routine reductions, enhanced sanitation and basic monitoring will largely mitigate the rat problems. A successful program will stress the long-term and ongoing nature of the solution. Too often, similar problems are quickly arrested in the short-term, only to reoccur later when the original actions are slowed or discontinued.

The West Indian Mongoose (*Herpestes auropunctatus*) came to the Caribbean and to St. John on a ship from Calcutta about 1884. It was thought to be the salvation for the large sugar cane plantations on the islands that were being ravaged by tree rats. At first, the statistics indicated that a significant rat population decline had occurred and it was attributed to mongoose predation. As a result, in the next 30 years (1872 to 1900) even more mongooses were distributed throughout the Caribbean as a biological control.

Eventually, it was discovered that rats that sought out their meals at night didn't cross paths with the daytime foraging mongoose. However, because rats are nocturnal and mongooses diurnal creatures, they coexist well and we now have both non-native species to contend with. Problems compounded as the rats continued to enjoy sugar cane and the mongoose feasted instead on bird and sea turtle eggs, lizards, insects, papaya and guava.

Norway and tree rats enjoy the spoils of human habitation, as well as, our garbage. That's why the greatest rat concentrations are near human populations and the Park campgrounds and day use areas. There has been much effort and expense by the National Park Service to animal-proof trash containers in the Park. Statistics show that if human garbage is controlled, the non-native rat population will decline—a story similar to decline of bear-human conflicts in many other national parks in the conterminous U. S. The actions with the greatest impact on reducing the number of non-native rats involve reducing or eliminating the available food on a regular basis.

Because reptiles, amphibians and invertebrates, such as insects, are small, often slow and readily available on St. John, they are particularly susceptible to local extinction from non-native rat depredation. Of particular concern are the varied native reptile and amphibian populations in the Virgin Islands National Park and their links to the ecological web of the island. Non-native rats prey upon three species of tree

frogs, two geckos, three Anolis lizards, the ground lizard, legless lizard, blind snake, the Puerto Rican racer, and the slipperyback skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1,500 beetle species; non-native rats may eat all of which.

Great numbers of wildlife, therefore, are lost each year to a relatively large non-native rat population. The cumulative impacts associated with these increasing wildlife losses are significant. Small islands typically have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts to a larger landmass.

Non-native rats prey upon endangered hawksbill and leatherback sea turtles, which nest on St. John. Both Norway and roof rats kill emergent hatchlings as they crawl from the nest to the ocean at night, when the rats are most active. Non-native rats will also prey upon sea turtle nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones. The sea turtle recovery plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is, therefore, a violation of the Endangered Species Act.

Non-native rats prey upon chicks, juveniles and adults of most bird species that nest on St. John. Of particular concern are endangered brown pelicans, least terns and threatened roseate terns. Territorial endangered species preyed upon by non-native rats include ground and tree nesting species such as bridled quail dove, Bahama pintail duck, and the Antillean mango hummingbird, all of which suffer egg and chick death due to rats. Non-native rats also prey upon four (of the five) native bat species, three of which are territorially endangered, and the only indigenous mammals on the island.

Non-native rats have established breeding populations throughout Virgin Islands National Park. Their numbers are highest at Cinnamon and Trunk Bays, but smaller non-native rat populations are present at Hawksnest and Francis Bays, Annaberg Sugar Plantation, Saltpond Bay and Great Lameshur Bay. Non-native rats are found everywhere on St. John.

Food for non-native rats is present throughout the Park from a variety of sources, including trash receptacles, roadside litter, and local wildlife. A small Park with numerous non-native rat populations numbering over about 2,000 animals will have a very serious deleterious effect on the natural environment.

An intensive, rapid population reduction effort is necessary to reduce the present populations to an acceptable level. Because additional non-native rats would enter the Park from adjacent lands, an acceptable population size (limit) must be established. The population must be periodically censused to ensure the program goals are achieved (Main, Hiemstra, and Long 1972; Arnold 1986).

A comprehensive Non-native Rat Control Plan is necessary with the following elements: problem identification; acceptable densities; enhanced food handling, storage and waste practices (including trash pickup schedules); written guidelines for visitors, NPS and concessions employees; and routine removal and monitoring efforts. During dry periods non-native rats become more aggressive when their need for water increases. Also, when more food becomes available their numbers increase dramatically in a short time. Basic education, routine reductions, enhanced sanitation and basic monitoring would largely mitigate the non-native rat problems. A successful program would stress the long-term and ongoing nature of the solution. Too often similar problems are quickly arrested in the short-term, only to reoccur later when the original actions are slowed or discontinued. Indian mongooses are one of many

Non-native Domestic Cat Impacts

Domestic cats originated from an ancestral wild species, the European and African Wild Cat (*Felis silvestris*). The Domestic Cat (*Felis catus*) is now considered a separate species. The estimated numbers of pet cats in urban and rural regions of the United States have grown from 30 million in 1970 to nearly 65 million in 2000. Reliable estimates of the present total cat population are not available. Nationwide, approximately 30% of households have cats. In rural areas, approximately 60% of households have cats. Populations of birds on oceanic islands have evolved in circumstances in which predation from mammalian predators was negligible and they, and any other island vertebrates and invertebrates, are therefore particularly vulnerable to predation when non-native cats have been introduced.

The impacts of domestic cats on wildlife are difficult to quantify. However, a growing body of literature strongly suggests that domestic cats are a significant factor in the mortality of small mammals, birds, reptiles and amphibians. Because free-ranging cats often receive food from humans, they can reach population levels that may create areas of abnormally high predation rates on wildlife. When the wildlife prey is a threatened or endangered species, the results may be extirpation or extinction. Effects of cat predation are most pronounced in island settings (both actual and islands of habitat), where prey populations are already low or stressed by other factors, or in natural areas where cat colonies are established.

Extensive popular debate over absolute numbers or types of prey taken is not productive. The number of cats is undeniably large. Even if conservative estimates of prey taken are considered, the number of prey animals killed is immense. Feeding cats do not deter them from killing wildlife, as they do not always eat what they kill. Humans introduced cats to North America and they must be responsible for the control and removal of cats that prey on wildlife.

The National Park Service fully supports the policy of The Wildlife Society (March 2001) in regard to non-native and free-ranging domestic cats is to: 1) strongly support and encourage the humane elimination of non-native cat colonies; 2) support the passage and enforcement of local and state ordinances prohibiting the public feeding of non-native cats, especially on public lands, and releasing of unwanted pet or non-native cats into the wild; 3) strongly support educational programs and materials that call for all pet cats to be kept indoors, in outdoor enclosures, or on a leash; 4) support programs to educate and encourage pet owners to neuter or spray their cats, and encourage all pet adoption programs to require potential owners to spray or neuter their pet; 5) support the development and dissemination of sound, helpful information on what individual cat owners can do to minimize predation by free-ranging cats; 6) pledge to work with the conservation and animal welfare communities to educate the public about the negative impacts of free-ranging and non-native cats on native wildlife, including birds, small mammals, reptiles, amphibians and endangered species; 7) support educational efforts to encourage the agriculture community to keep farm cat numbers at low, manageable levels and use alternative, environmentally safe rodent control methods; 8) encourage researchers to develop better information on the impacts of non-native and free-ranging cats on native wildlife populations; 9) recognize that cats as pets have a long association with humans, and their responsible cat owners are to be encouraged to continue caring for the animals under their control; and 10) oppose the passage of any local or state ordinances that legalize the maintenance of “managed” (trap/neuter/release) free-ranging cat colonies.

Domestic cats have established breeding populations in many areas of the Virgin Islands National Park. These colonies are termed non-native; the animals are neither domestic nor wild. Non-native cat populations are highest at Cinnamon and Trunk Bays, but smaller non-native colonies are present at Hawksnest and Francis Bays, Annaberg Sugar Plantation, Saltpond Bay and Great Lameshur Bay. Also, many non-native cats live independently of these colonies and range into and affect surrounding areas.

Cats hunt for both fun and food. Unlike wild predators, domestic cats hunt whether they are hungry or not. These cats are called “subsidized predators” because they sometimes receive a steady supply of food at home. Pet cats can hunt longer and are less susceptible to disease than many wild predators.

Because non-native cats routinely kill insects and other small animals for “sport” to practice their hunting skills, in addition to using them as a food source, great numbers of wildlife are lost each year to a small non-native cat population. A recent university study in Wisconsin ((Fish and Wildlife Today 1998) estimated that “ 1 to 2 million free ranging rural cats in Wisconsin kill roughly as many as 217 million birds each year.” Researchers noted that birds make up only 20 percent of the cats’ diet. Seventy percent of the diet was small mammals and 10 percent reptiles and amphibians (Patronek 1997; Coleman and Temple 1995). Thus, great numbers of wildlife can be lost each year to a small non-native cat population.

Virginia researchers compared free-roaming domestic pet cats in a rural setting and a more urban one. A total of 27 native species (eight bird, two amphibian, nine reptile, and eight mammals, including the star-nosed mole, a species of special state concern) were captured by a single rural cat. Four urban cats captured 21 native species (six birds, seven reptiles, and eight mammals). Between January and November 1990 each cat caught, on average, 26 native individuals in the urban area, and 83 in the rural area. The study did not count prey killed and completely consumed, prey killed and left elsewhere, or non-native prey (Mitchell and Beck 1992).

It has been extensively documented that domestic cats can severely impact seabird populations on islands (Moore and Atkinson 1984), and well-fed cats still kill wildlife (Adamec 1976). Cats and other predators can also have an impact on songbird populations in fragmented and isolated habitat (Wilcove 1985). In a scientific study in two California parks—one with over 20 cats that were fed daily, and one without cats, the researchers found that cats at artificially high densities, sustained by supplemental feeding, reduced the abundance of native rodent and bird populations, changed the rodent species composition, and may have facilitated the expansion of the house mouse into new areas. The scientists recommended that the feeding of cats in parks should be strictly prohibited (Hawkins, Grant and Longnecker 1999).

Because reptiles, amphibians and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from non-native cat depredation. Of particular concern are the native reptile and amphibian populations in the Virgin Islands National Park and their links to the ecological web of the island. Non-native cats prey upon three species of tree frogs, two geckos, three Anolis lizards, the ground lizard, legless lizard, blind snake, the Puerto Rican racer, and the slipperyback skink living on St. John. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1,500 beetle species; non-native cats may eat all of which. The cumulative impacts associated with these increasing wildlife losses can be significant. Small islands typically have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts on a larger landmass.

Domestic or non-native cats kill chicks, juveniles and adults of most bird species nesting on St. John. Of particular concern are endangered brown pelicans, least terns and the threatened roseate terns. Non-native cats may also prey upon hatchling hawksbill sea turtles as they travel from nest to the sea at night. The sea turtle recovery plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is, therefore, a violation of the Endangered Species Act.

Non-native cats also prey upon four (of the five) native bat species, three of which are territorially endangered, and the only native mammals on the island. Other territorial endangered species include

ground and tree nesting species such as bridled quail dove, Bahama pintail duck and Antillean mango hummingbird, all of which may suffer egg and chick death due to cats. The Endangered Species Act stipulates that predators should be removed from nesting sites and noncompliance is therefore a violation of the Endangered Species Act.

Wildlife officials believe the best way to reduce the damages to bird, reptile, amphibian, insect and other small wildlife populations from free-ranging cats is for cat owners to keep their pets indoors. Many stateside municipalities currently have ordinances that require cats to be kept indoors or on a leash. However, these measures are rarely enforced, causing some bird fans to take matters into their own hands.

Foods are present throughout the Park from a variety of sources, including trash receptacles, roadside litter, and local wildlife. In addition, feeding by visitors and residents occurs regularly. Non-native animal behavior ranges from being completely tame and affectionate too wild and aggressive.

As a result, many cats will continue to suffer due to rejection from established territorial colonies and the resultant insufficient food supply. More cats will fight and more will have insufficient nourishment as their populations increase. At the same time, they will breed and produce more animals to exacerbate the problem. A small Park with numerous non-native cat populations numbering over 200 animals is negatively impacting the natural environment.

The cat problem is exacerbated because people routinely abandon kittens and adults within and near Park boundaries. The owners believe the cats will be taken care of in the Park and would be dispatched if taken to the Humane Society. They are partially correct, because people routinely feed cat colonies in the Park, and many animals must be destroyed by the Humane Society.

Any viable solution must include a partnership with the local community and ongoing outreach and education efforts. This partnership should include the local non-profit St. John Animal Care Center because some members have routinely fed non-native cat populations within and near Park boundaries (American Veterinary Medicine Association, Animal Welfare Forum 1996).

Non-native West Indian Mongoose Impacts

In the 1880's, European planters introduced the West Indian Mongoose (*Herpestes auropunctatus*) to the Caribbean and to St. John as a biological control to suppress the tree rat populations that decimated sugar cane fields (Nellis and Everard 1983). It was thought to be the salvation for the large sugar cane plantations on the islands that were being ravaged by tree rats. At first, the results indicated that a significant decline in the rat population had occurred and the decline was attributed to mongoose predation. As a result, in the next 30 years (1872 to 1900), even more mongooses were distributed throughout the Caribbean as a biological control.

Soon it was discovered that rats that sought out their meals at night didn't cross paths with the daytime foraging mongooses. Rats are nocturnal and sleep in trees during the day. They were therefore able to eat as much sugar as they wanted by night, while the mongooses were sleeping. The rats were safe, during the day, from the mongooses, which cannot climb trees. They coexist well and we now have both exotic species to contend with. Mongoose populations are scattered throughout St. John, with the highest concentrations near human populations, due to increased food availability. Mongooses have no biological predators and populations rise sharply when sufficient food quantities become available (Nellis and Small 1983).

Problems compounded as the rats continued to enjoy sugar cane and the mongoose feasted instead on bird and sea turtle eggs, as well as insects and fruit. Public health concerns increased when the mongoose was

discovered to be a carrier of rabies. Since mongooses have no natural predators here, the checks and balances of natural population control are missing.

Non-native mongooses enjoy the spoils of human habitation, as well as, garbage. That's why the greatest mongoose concentrations are near human populations, Park campgrounds and day use sites. There has been much effort and expense by the National Park Service to animal-proof trash containers in the Park. Statistics show that if human garbage is controlled, the mongoose population will decline—a story similar to decline of bear-human conflicts in many other national parks in the conterminous U. S. The actions with the greatest impact on reducing the number of non-native mongooses involve reducing or eliminating the available food on a regular basis.

No one knows the exact mongoose population on St. John, though the speculation is that there are approximately 1,000 animals concentrated along the moister northern shore. They do not construct a nest, but curl up on the leaf litter to sleep at night. The average size of a mongoose family is mother and two offspring that are carried for 49 days. Their eyes open at 16 days and their first venture from their nests is at 25 days. They have a full set of teeth at 22 weeks. An interesting bit of trivia is that the weight of the lens of the eye is an indicator of the age of a mongoose. The average mongoose will claim about 8 acres as their territory.

Because reptiles, amphibians and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from being preyed upon by non-native mongoose. Of particular concern, are the varied native reptile and amphibian populations in the Virgin Islands National Park and their links to the ecological web of the island. Non-native mongooses prey upon three species of tree frogs, two geckos, three Anolis lizards, the ground lizard, legless lizard, blind snake, the Puerto Rican racer, and the slipperyback skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1,500 beetle species; non-native mongooses may eat all of which.

Mongooses enter a “feeding frenzy” behavior, during which they kill and maim every insect and other small animals they encounter, in addition to using them as a food source. Great numbers of wildlife, therefore, are lost each year to a relatively large mongoose population. The cumulative impacts associated with these increasing wildlife losses are significant. Small islands typically have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts on a larger landmass.

Non-native mongooses are primary predators of endangered hawksbill and leatherback sea turtles, which nest on the island. Mongooses will prey upon sea turtle nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones. They will also prey upon a nest just before or immediately after hatching as the emergent hatchlings crawl from the nest to the ocean in the early morning hours, when mongooses begin to hunt. Often, hatchlings trickle from their nesting cavity over a period of several hours, leaving them susceptible to mongoose predation in the daytime. The sea turtle recovery plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is therefore a violation of the Endangered Species Act.

Non-native mongooses prey upon chicks, juveniles and adults of most bird species that nest on St. John. Of particular concern are their preying upon endangered brown pelican, least tern and the threatened roseate tern. Territorial endangered species preyed upon by non-native mongooses include: ground and tree nesting species, such as bridled quail dove and Bahama pintail duck; and the Antillean mango hummingbird, all of which suffer egg and chick death due to mongooses.

Non-native mongooses also prey upon four (of the five) native bat species, three of which are territorially endangered, and the only indigenous mammals on the island. The Endangered Species Act stipulates that predators should be removed from nesting sites and noncompliance is, therefore, a violation of the Endangered Species Act.

Mongooses have established breeding populations throughout Virgin Islands National Park. Their numbers are highest at Cinnamon and Trunk Bays, but smaller mongoose populations are present at Hawksnest and Francis Bays, Annaberg Sugar Plantation, Saltpond Bay and Great Lameshur Bay. Mongooses are ubiquitous on St. John.

Mongoose foods are present throughout the Park from a variety of sources, including trash receptacles, roadside litter, and local wildlife. In addition, feeding by visitors and residents occurs occasionally. A small Park with numerous non-native mongoose populations numbering over about 1,000 animals will have a very serious deleterious effect on the natural environment.

The actions to reduce non-native rats have the double advantage of also limiting non-native mongoose populations (Nellis and Small 1983, Boulon 1999). The actions with the greatest impact on reducing the number of mongooses involve reducing or eliminating the available food on a regular basis (Nellis 1982).

Biological Pollution (Exotic Plants)

Harmful exotic plants can have profound environmental consequences ranging from wholesale ecosystem changes and extinction of indigenous or native species, especially on islands, to more subtle ecological changes and increased biological sameness (monospecific forests). Both intentional and accidental introductions of harmful non-indigenous plants occur. Intentional introductions take the form of ornamental plants to enhance perceived beauty or of crops, fruit trees and medicinal plants to generate a new source of food or income. Accidental introductions arrive as contaminants or hitchhikers on bulk commodities, packing material, in ship ballast, seed shipments and soil. Agricultural inspections of plants entering the Virgin Islands through customs are cursory at best. No inspections are done on cargo transported between the Virgin Islands. An inventory of exotic species and determination of their status in the Park are needed. If the species interferes with Park objectives, has the ability to alter ecosystems, can spread to natural communities, can out-compete native species or is allelopathic, management actions need to be evaluated and implemented.

Forest Recovery, Fragmentation and Vegetation Removal

Altered and degraded forest systems are recovering from the clear-cutting done in plantation days. Most species are still present, but composition and forest structure do not yet resemble pre-plantation descriptions of the forests. Ecological succession to dominant communities is being monitored. Grazing and browsing by non-native livestock and development pressures are the worst threats. The few remaining mangrove forests have been considerably stressed by recent hurricanes: Hugo (1989), Luis (1995), Marilyn (1995), Bertha (1996) and Georges (1998) and development pressures. Fragmentation of small natural areas into even smaller parcels is a threat to natural systems and processes.

Vegetation removal is done frequently. The Park maintains seven scenic vistas and 34 kilometers (21 miles) of Park trails, and mows the roadside along the North Shore Road. Volunteer groups from the community, the American Hiking Society, the Appalachian Mountain Train Club and other interested parties have assisted with keeping trails open for hikers. A vegetation removal guide and training are needed to protect native saplings, endangered and threatened species, and ensure the safety of workers from poisonous plants with toxic sap and thorns.

Taxi drivers have illegally removed vegetation to make additional scenic vistas. People in the community also cut and collect plants for crafts, livestock and gardens. Endangered, threatened and rare species need protection from these illegal and largely covert activities. Increased education, institution of broader collection permits requirements and increased ranger patrols are necessary to reduce illegal vegetation removal.

Garbage Disposal and Recycling

Until 1994 the St. John solid waste disposal site was essentially an open landfill located at Susannaberg, 2.4 kilometers (1.5 miles) east of Cruz Bay, south of Centerline Road. The Territorial Department of Public Works manages it. This landfill served the needs of the entire island, including the Park until it was closed after a large fire erupted and eventually was put out in 1992. The landfill has been capped and closed according to the Environmental Protection Agency's standards, however, leachates carrying contaminants may wash down Guinea Ghut or seep into the groundwater during heavy rainstorms. Garbage generated on St. John is still taken to the landfill site, where it is loaded onto trucks, barged to St. Thomas and deposited in the Bovoni landfill. That landfill has also exceeded capacity and resource recovery alternatives are being explored by the VI Government for that landfill.

Twelve percent of the contents of the landfill are metal, 40% is paper and 5% is glass. If just these materials were recycled, the volume of garbage going to the landfill would be decreased by over 50%. If composting household garbage, grass and leaves were done; another 23% in volume would be reduced. The Park, the VI Anti Litter and Beautification Commission (VIALBC) and a few key local citizens has initiated recycling programs for aluminum. Recycling would decrease the volume of garbage sent to the landfill as well as save energy. Ninety percent of the energy it takes to manufacture aluminum from virgin materials can be saved if aluminum is recycled.

III.C. CULTURAL RESOURCES

This section of the Environmental Assessment describes the current status of baseline information from inventories, monitoring and research projects. Major Park planning documents have been completed. Some are in the process of being updated; the Land Use Plan, Statement for Management, and the Resource Management Plan. Virgin Islands National Park needs an update to major inventories and documentation of cultural resources in addition to special studies and an administrative history.

History

Three waves of migrations brought Native Americans north from the Orinoco River valley of Venezuela. By the time of European discovery of the New World, two prehistoric Indian groups inhabited or visited the Virgin Islands, the Arawaks or Tainos and the more aggressive Caribs. On November 4, 1493, Christopher Columbus and a fleet of 17 ships made land fall in the Lesser Antilles beginning two centuries of international wars for supremacy of the West Indies, disrupting native customs and deforesting the land. The Columbus expedition did land on St. Croix, probably at Salt River.

Beginning in 1718, St. Thomas and St. John were colonized by the Danish West India and Guinea Company. Landholdings were cleared and cultivated. These "plantages" or "plantations" relied on slave labor and sizable capital investment. On St. John in 1733-4, development was slowed and nearly stopped by an almost successful slave uprising. The Danish West Indies became a crown colony in 1755 and development accelerated. By 1780, the greater part of St. John was under cultivation. Early crops included cotton, tobacco and dye woods such as indigo, but shifted predominantly to sugar. The rugged terrain, the thin rocky soil and labor-intensive economies created problems. As long as sugar prices remained high and African slaves were easily available, agricultural development was financially viable.

Denmark abolished trade in slaves in 1792. By the 1800s, sugar prices dropped. Plantation economy became marginal. By the mid-1800s, competition with areas where mechanical cultivation of both sugar and cotton and the increased production of the European sugar beet was too much and some plantations folded. In 1848 slavery was abolished in the Danish West Indies. The plantation systems succumbed. Only a few plantations lasted into the 20th century. They introduced crops that produced bay and lime oil, mechanically crushed sugar, or they attempted to raise and sell livestock.

The breaking point for most remaining plantations occurred in 1867. Following a major hurricane and earthquake, tracts of cultivated land were abandoned or allowed to shrink. The population declined. Land reverted to natural vegetation that buried the collapsing remains of the once flourishing agricultural buildings. In 1917, the Danish West Indies was ceded to the United States. The territory of the Virgin Islands was created in 1931 and is currently administered by an elected governor and legislature. Oversight authority for the territory rests in the U.S. Department of Interior.

Now the islands are based on a tourist economy. After World War II, with rising wages and improved large-scale commercial air travel, mass tourism became reality. The over one million tourists per year originate predominantly from the United States (64%), Europe (10%) and Canada (7%). Beginning in the 1950s, St. Thomas became a popular destination for Caribbean cruise ships that send passengers to St. John for day trips. The island, which once harbored fewer than 800 people living mostly in two-room wooden cottages without indoor plumbing, electricity or telephones and their only means of transportation a donkey or a horse, has undergone a dramatic transformation. A population of over 4,500 persons is now sustained by wage employment that allows many to live in modern housing and own cars.

The Virgin Islands National Park was welcomed when it was established in 1956 on St. John. It was thought that the Park would provide economic opportunities for local Virgin Islanders. But, the Park has been developed as a "natural area", following a U.S. concept of nature foreign to St. Johnians. The general policy adopted by the Park dictated that land be "managed 'back' toward pristine condition" that had prevailed "when the area was first visited by the white man" (Administrative Policies 2001). Access to economic resources in the Park has been restricted, severely limiting traditional use of the environment. The tourist industry created only limited economic opportunities for St. Johnians.

After the Park was established, it undertook the task of undoing the effect of almost 250 years of cultivation. If a St. Johnian had a garden plot under cultivation on land acquired by the Park, the plot could continue to be cultivated but no new land could be cleared. Soil was depleted within several years and the traditional extensive swidden agriculture ceased. Cattle grazing on Parklands were forbidden. No longer permitted to turn their cattle loose on a nearby estate during periods of drought, farmers were forced to slaughter them. Even though hunting and trapping had never been a major part of the local economy, the Park set up large signs prohibiting it. There was a fine of \$500 or six months in prison for any person violating Park rules.

Archeological Sites

The Virgin Islands prehistorically are part of a larger Caribbean Culture Area. This area consists of two distinct chains of islands. The Lesser Antilles are a line of small, mainly volcanic islands sweeping northward from Trinidad near the mouth of the Orinoco River in Venezuela. The Greater Antilles consists of a chain of four large islands: Puerto Rico, Hispaniola (Haiti and the Dominican Republic), Cuba and Jamaica. American Indians prior to discovery inhabited the Virgin Islands by the Spanish explorers.

The earliest occupation of the Americas was detected around 10,000 BC. During the last glaciation when a land bridge formed between Asia and North America, small highly mobile bands of hunters and gatherers reached America. They hunted large megafauna such as the mastodon and mammoth. It is not

thought that the Antilles were inhabited during this period (13,000 to 7,900 BC). The earliest recorded prehistoric site for the Caribbean Culture Area is the El Jobo Site in Venezuela. This culture was probably an offshoot of the North American big game hunting tradition.

During the next period of time, the hunter/gatherer groups became more organized and spread out. They developed storage pits, began collecting shellfish, developed habitations, prepared their dead for burials, traded with other groups and developed the atlatl to increase hunting prowess. This period of time is called Archaic on the mainland (8,000 to 1,000 BC) and Meso-Indian in the Caribbean (5,000 BC to AD 0). The only known site representing this period of time in the Virgin Islands is the Krum Bay Site on St. Thomas although there may be a site as old as 700 AD at the west end of Cinnamon Bay beach.

The third broad period of pre-history is called the Neo-Indian in the Caribbean (AD 0 to contact with Europeans). During this period of time, there was an increase in horticulture, ceramic pottery use and there was a shift to a more sedentary lifestyle. Several waves of culture groups left the Orinoco valley in Venezuela and migrated northwards. Just a few hundred years prior to contact with Europeans, the Arawaks had begun to be displaced by this last migrant group. By European contact, the Caribs had occupied all of the Lesser Antilles including the U.S. Virgin Islands.

Twenty-two prehistoric sites have been recorded on St. John, thirteen of which are on National Park Service land. Only two of these sites are currently on the National Register, the Reef Bay petroglyphs and the Cinnamon Bay site. Nine additional sites may be eligible for National Register listing. The largest and best-known site on St. John is at Coral Bay outside the Park boundary.

The subsistence economy of these Archaic people was based on collecting plants, fishing and small game hunting with an emphasis on the exploitation of maritime resources. No large mammals were present on St. John. The Iguana (*Iguana iguana*), Hutia (*Isolobodon*), and several bird species provided land-based meats. The hutia, a small rodent-like animal, and the iguana are thought to have been introduced to St. John by Arawak settlers. Reef fish were the most important and easiest to exploit. The Manatee (*Trichechus*) was known to have been used by aboriginal and historic settlers alike. Shellfish were abundant, with Conch (*Strombus*) and the West Indian Topshell (*Cittarium pica*) being found the most often in the archeological record. Spiny lobster and crabs were also utilized for food. Recent evidence from Cinnamon Bay shows that the Caribbean Monk Seal as well as freshwater turtles, snakes and a number of rails were also consumed.

Non-native wild hogs destroy irreplaceable archeological sites and degrade the scientific importance of the St. John Archeological Districts located at Cinnamon and Reef bays. Damage to archeological sites by non-native hogs continues essentially unabated. Pig rooting of archeological sites on the island has resulted in their loss of integrity, and ultimately loss of the values that make the St. John Island Archeological Districts eligible for the National Register of Historic Places.

Historic Structures

The most conspicuous structures, both in volume and size, are the remains of sugar plantations. They are found predominantly along ridges of the north coast and valleys of the south coast of St. John, where drainages were good for growing sugar cane. On drier areas of the island, cotton and livestock were raised.

Consolidation of small landholdings to larger economically feasible ones occurred over time. From 1728 Danish tax records, 91 plantation lots were counted on St. John. Only half of these were under development. Seventy-two years later, in 1800, P.L. Oxholm mapped 68 plantations, 41 of which were

within the current authorized Park boundaries. Currently there are 46 historic plantations within the authorized boundary, 31 of these are on federal land.

There are 236 historic structures on the 1989 List of Classified Structures for St. John. Seventeen of these are still roofed or with vestiges of roofing. Nine structures are in use. Sixteen historic districts are recorded on the National Register, all of which are on federal land. These contain 180 individual structures. Seven individual structures are recorded on the National Register, four of which are on federal land. Structures range in function from Danish plantation great house, cook house, slave village and sugar processing factory to colonial fort and battery, to a school and even a guard custom house. They date from 1718. Many of the structures have fallen to ruinous piles of rock not considered salvageable and should be removed from the List of Classified Structures (LCS) and added to the Cultural Sites Inventory (CSI) as historic archeological sites. Basic inventories are not complete. Portions of structures and new historic archeological sites hidden by years of vegetative growth are still being discovered. Historic structure reports have not been completed for most structures undergoing stabilization.

No National Landmarks are yet listed for the island of St. John, although there are six worthy of nomination. Two sites were nominated in 1994: Fortsberg and the Reef Bay Great House Plantation manager or owner residences were usually with the area of production or on higher ground overlooking the factory. Slave quarters or "villages" were placed on the periphery of the production center. Most plantations included an orchard and plot for raising vegetables. Terrain dictated the pattern, either grid or terracing with walls. Existing roads and trails generally follow original cart roads that should also be considered part of the cultural resource.

Architecture was rural in character and utilitarian of purpose. The most common construction was rubble masonry using locally available fieldstone set in lime mortar with liberal use of imported brick for framing doors, window openings, arches and quoining of corners. Much rubble and brick masonry has traces of a parged or plaster finish. Stucco inlays of colored plaster ornamentation was frequent in principal buildings. The Reef Bay Great House and Hammer Farm are excellent examples of the use of ornamentation. Characteristic, but not common, was the use of blocks of cut and fitted brain coral that was usually left exposed. Annaberg is an excellent example of this architectural style. Clay wing tile, both glazed and unglazed, was not an unusual roofing material. Flooring made of brick, clay tile or Gotland limestone flagging was widely used. The few remaining well-preserved structures indicate that workmanship was excellent.

The most significant and complete historic structures on St. John under Park jurisdiction have been cleared of vegetation and stabilized to provide a degree of protection against further deterioration. The work has been predominantly limited to masonry repair of standing walls. The Reef Bay Sugar Factory has been re-roofed with lightweight modern galvanized-type roofing to protect the machinery and other features of the interior. Significant structures that have been stabilized include the Reef Bay Sugar Factory which is the best preserved example of technology used in mid-19th century sugar making, the Cinnamon Bay sugar plantation which was one of the first established on the island and site of significant events during the 1733 slave rebellion, the Annaberg sugar plantation illustrating an excellent example of a complete factory complex, and the Hammer Farm (also called Catherineburg) windmill tower with unique ramp and vaulted storage.

The Reef Bay Great House is considered the most important historic structure in the Park and illustrates West Indian formal architecture. It is on the National Register (H-15) and has been nominated for National Historic Landmark status. Fish plates and tie rods were installed in some walls of the Reef Bay Great House to increase structural strength, but have now been removed. Reconstruction of the walls of southwest corner was needed to stabilize it and keep it from imminent collapse. This was completed in

1993. The structure has also been re-roofed with sheets of galvanized aluminum. Plastering of the exterior is still needed.

Fourteen known historic districts and one individual building exist on inholdings within the authorized boundary on St. John. Nine of them may qualify for nomination to the National Register for their historical associations and their integrity. They include: Caneel Bay Plantation (H6); Susannaberg Plantation (H7); Adrian Plantation (H8); Oynes Point Custom Guard House (H9); Leinster Bay Plantation (H29); More Hill (H38); Frederiksdal and Mount Pleasant (H41). The State Preservation Office has nominated two of them to the National Register: Frederiksvaern, Fortsberg, Coral Bay (H44); and Whistling Cay Customs Guard House (H47).

The major environmental impact to the historic structures is growth of vegetation and undermining of historic structures by burrowing, vegetation grazing, and fecal and urine contamination by non-native rats. Plants penetrate soft mortar and plaster surfaces working themselves deeper into the structure forming cracks through pressure against surfaces as they grow and providing avenues for moisture and rainfall to enter. Consistent, constant removal of vegetation continues to be one of the major efforts in stabilizing major Park structures. By removing non-native rats from these sites, there would be safer, cleaner, healthier and more stable structures for interpretation and enjoyment.

IV. CHAPTER IV: ENVIRONMENTAL CONSEQUENCES

Chapter IV discloses the environmental consequences of implementing each of the six alternatives described in Chapter II. This analysis of environmental consequences is largely a qualitative assessment of the effects of the alternatives on eleven natural and cultural resources categories.

IV.A. Non-native Rat Control

III.B.1. Alternative 1. No Action

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values would decline under this alternative as native flora and non-native rats increasingly depredate fauna because rats would continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetics near dumpsters would decline as trash is scattered and carried into the bush and nearby roadsides.

Cultural Resource Impacts

Cultural resource impacts would increase at historic sugar plantations throughout the Park and particularly near developed areas with heavy visitation. The burrowing, vegetation grazing and seed dispersal would continually undermine the historic fabrics, increasing destabilization and vegetation removal costs and frequencies. Fecal and urine contamination throughout these valuable resources would continue unabated, causing health and safety concerns for visitors at these sites.

Socioeconomic/Visitor Use Impacts

Tourism may slightly decrease, especially overnight stays at camping facilities, under this alternative. The visitor experience would decline because if visitors visit fewer sites and stay shorter periods because of negative experiences with non-native rats. This is especially true if people encounter non-native rats during daylight hours anywhere in the Park but particularly in eating facilities and sleeping quarters. Virgin Islands National Park campgrounds are severely impacted by non-native rat populations entering tents, eating food and other items and depositing fecal materials on personal belongings.

Soil Impacts

No significant soil impacts would occur under this alternative. However, increased tunneling within, under and adjacent to historic or modern structures could decrease their stability. More tunnels within which seeds are transported could undermine the stability and integrity of all buildings and especially the cultural landscapes.

Threatened and Endangered Species Impacts

Non-native rats would continue to predate listed species. In St. John the listed species include the Endangered Hawksbill and Leatherback sea turtles (eggs and hatchlings), Endangered Brown Pelicans and Least Terns, and Threatened Roseate Terns (eggs and chicks).

Non-native rats also depredate four (of the five) native bat species, three of which are Territorially Endangered, and the only indigenous mammals on the island. Other Territorial Endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck and Antillean Mango Hummingbird, all of which suffer egg and chick depredation due to non-native rats.

Vegetation Impacts

There would be no change in the type or level of impacts to native vegetation under this alternative. This is particularly important in the dry season, when bark and leaves are consumed for their moisture content. In addition, fewer seeds from exotic plant species would be dispersed in non-native rat fecal matter and in burrows. This complex ecological problem is exacerbated over time as the accumulative affects multiply and have a greater influence on the vegetation island-wide, as well as the fauna and micro-habitats found within the vegetation.

Wildlife Impacts

Native wildlife would be adversely impacted by this action because significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species are depredated by Norway and roof rats.

Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from non-native rat depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. Non-native rats prey upon three species of tree frogs, two geckos, three Anolis lizards, the ground lizard, legless lizard, blind snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are preyed upon by non-native rats. Many invertebrate species may be lost before researchers have catalogued them.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

Adverse impacts to wetlands, mainly saltponds, would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of rats throughout the Park. This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation.

Park Operations Impacts

Under this alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas. During the last year, Virgin Islands NP has purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

Cumulative Impacts

The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife. Every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, bats, tree frogs and insect species. Eventually, many species would become locally extinct, some before they are even identified by researchers.

Under this alternative, no baiting would take place and therefore, risk of rodenticide exposure would be restricted to non-target species in and around Park buildings where non-native rat control with rodenticides would continue to take place.

Health and sanitation impacts would continue to decline under this action. More rats would disperse more disease causing organisms in more places, including tents, picnic tables, sinks and bathing facilities. Problems in campgrounds would continue and some people may choose not to visit St. John as a result, and those who do may reduce their stay and have a negative experience. This is certainly true when rats must forage for food in the daytime as populations exceed carrying capacities.

This alternative would adversely affect the approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Territory of the U. S. Virgin Islands for reasons described above.

III.B.2. Alternative 2. Proposed Action – Sustained Reduction

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values would be enhanced under this alternative as the native flora and fauna species depredated by non-native rats' increase, resulting in more native fauna and flora sightings because rats would no longer continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetic environment near dumpsters would be enhanced when trash and food wastes are not seen and offensive odors are reduced.

Cultural Resource Impacts

Cultural resource impacts at the numerous historic sugar plantations throughout the Park and particularly near developed areas would be mitigated by significantly decreasing the non-native rat population and sustaining the reduction. This effort would reduce the impacts from burrowing, vegetation grazing and fecal and urine contamination throughout these valuable resources. The result would be safer, cleaner, healthier and more stable structures for interpretation and enjoyment.

Socioeconomic/Visitor Use Impacts

Visitor use patterns should be enhanced with a possible tourism increase under this alternative or at least a reduced decline attributable to non-native rats. Potential visitors who opted to vacation in another area as the result of media coverage or word-of-mouth communication about the non-native rat problems may visit when the problems are resolved. The tourist experience at Virgin Islands National Park would be significantly improved.

Soil Impacts

Major soil impacts remain unchanged under this alternative. However, decreased tunneling within, under and adjacent to historic or modern structures would increase their stability. Fewer tunnels within which seeds are transported would enhance the stability and integrity of all buildings and especially the cultural landscapes. A reduction in vegetation removal expenses may be realized as well.

Threatened and Endangered Species Impacts

Both Norway and roof rats depredate eggs or chicks from all birds nesting on St. John. Of particular concern is depredation to Endangered Brown Pelicans (*Pelecanus occidentalis*), Least Terns (*Sterna antillarum*), and the Threatened Roseate Terns (*Sterna dougallii*). Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck and Antillean Mango Hummingbird, all of which suffer egg and chick depredation due to rats. Non-native rats are not primary predators of Endangered Hawksbill (*Eretmochelys imbricata*) and Leatherback (*Dermochelys coriacea*) sea turtles that nest on the island; however, non-native rats are involved in predation events each year. Both Norway and roof rats depredate emergent hatchlings as they crawl from the nest to the ocean at night, when the non-native rats are most active. The Sea Turtle Recovery Plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is therefore a violation of the Endangered Species Act.

The proposed action would not adversely impact any federally listed threatened or endangered species or Territorially listed endangered or rare species. The baits used would not produce secondary toxicity, and the trapping methods used would not entrap any threatened or endangered species (Campbell 1989, Conry 1994, Witmer *et. al.* 1998).

Vegetation Impacts

Native flora would be enhanced under this alternative because fewer rats would consume less vegetation. This is particularly important in the dry season, when bark and leaves are consumed for their moisture content. Also, fewer seeds from exotic plant species would be dispersed in fecal matter and in burrows.

Wildlife Impacts

Wildlife impacts would be positively mitigated by this action because significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species would benefit when the Norway and roof rat populations are kept low. In addition, five native bat species, the only indigenous mammals on the island, would benefit from reduced predation. Many bird, three bat and one reptile species are Locally Endangered by the Government of the U.S. Virgin Islands.

Because herptafauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from rat depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. Non-native rats prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are preyed upon by non-native rats.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

Wetlands and floodplains impacts are mitigated under this alternative. More native flora and fauna would exist in and adjacent to these areas as foraging and predation pressure from non-native rats' decrease.

Park Operations Impacts

Under this alternative, the overall costs of administration of the non-native wildlife control program would be increased with the implementation of contracts to remove exotic wildlife (\$30,000 with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division), purchase and installation of animal-proof trash receptacles and garbage cans, animal-proofing park and concessionaire structures, and construction of fences to exclude non-native animals from some developed areas.

Cumulative Impacts

The cumulative impacts from this alternative would have no negative consequences for National Park Service lands, wildlife and marine waters.

Fewer rats would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities. Maintaining a "residual" rat population level should result in non-native rats that avoid human habitations in both day and night time.

The Park's recently approved Commercial Services Plan/Final EA (2001) identified the need to establish a new mobile unit food services operation at Hawksnest Bay and new commercial services contracts for Trunk Bay and Cinnamon Bay Campground concessions. An integrated pest management approach would be included in any contract language that minimizes the adverse affects of non-native rats on Park facilities, daily concession operations and public safety.

This favorably affects and is, therefore, consistent with the approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Territory of the U. S. Virgin Islands.

IV.B. Non-native Cat Control

IV.B.1. Alternative 3. No Action

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values would decline under this alternative as the native flora and fauna species depredated by non-native cat's decrease in number because cats would continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetics near dumpsters would decline and trash would be scattered into the bush and nearby roadsides. The displeasing sight of viewing non-native cats on picnic tables or starving and begging for food in and around centers of human activity and along roadsides would increase.

Cultural Resource Impacts

No adverse cultural resource impacts would be expected under this alternative.

Socioeconomic/Visitor Use Impacts

Tourism may slightly decrease, especially overnight stays, under this alternative. Visitor experiences would decline because they may visit fewer sites and stay shorter periods if they have negative impacts at

the sites. This is especially true if people experience starving, emaciated and begging non-native cats at several areas within the Park. Increases of non-native cat transmitted disease among visitors could affect visitation and visitor experience.

Soil Impacts

No significant adverse soil impacts would occur under this alternative.

Threatened and Endangered Species Impacts

Non-native cats would continue to predate listed species. On St. John the listed species include the Endangered Brown Pelican, Least Tern and Hawksbill Turtle, and Threatened Roseate Tern and Green Turtle.

Non-native cats also depredate four (of the five) native bat species, three of which are Territorially endangered, and the only indigenous mammals on the island. Other Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck and Antillean Mango Hummingbird, all of which suffer egg and chick depredation due to non-native cats.

Vegetation Impacts

There would be no change in the type or level of impacts to native vegetation under this alternative.

Wildlife Impacts

Native wildlife would to be adversely impacted by this action because non-native cats depredate significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species. Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from non-native cat depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island.

Non-native cats prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are preyed upon by non-native cats. Many invertebrate species may be lost before researchers have catalogued them.

Non-native cats routinely kill insects and other small animals for sport, play, pleasure, practice or for no apparent reason, in addition to using them as a food source, therefore great numbers of wildlife are lost each year to a small non-native cat population. Both the cumulative impact and the secondary and tertiary impacts associated with this great and increasing wildlife loss is of significant importance. Small islands tend to have both smaller resident wildlife populations and lower species diversity. To exacerbate matters, non-native cats depredate a wide range of fauna, including ground, bush and tree-nesting birds and waterfowl, every native species of reptile, amphibian, mammal and literally hundreds of invertebrate species. These problems are particularly problematic on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts to a larger landmass.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

Adverse impacts to wetlands, mainly salt ponds, and would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of non-native cats throughout the Park. This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation.

Park Operations Impacts

Under this alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas. During the last year, Virgin Islands NP has purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

Cumulative Impacts

The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife. Almost every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, bats, tree frogs and insect species. Eventually, many species would become locally extinct, some before they are even identified by researchers.

Health and sanitation impacts would not be mitigated under this action. Health and sanitation impacts would continue to decline under this action. More non-native cats would disperse more disease causing organisms in more places, including tents, picnic tables, sinks and bathing facilities. Some people may choose not to visit St. John as the result, and those who do may reduce their stay and have a negative experience. This is certainly true when visitors' view emaciated cats on picnic tables, along roadsides and begging from scenic overlooks, premiere cultural sites and every public activity center they visit.

Moreover, the Park offers visitors a negative interpretative message, which highlights the problems encountered when non-native species are not managed. And the Park fails to protect the natural resources for enjoyment of future generations; the fundamental premise for which the Virgin Islands National Park was founded.

This alternative adversely affects approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Virgin Islands for reasons described above. The National Park Service has, therefore, determined that the program is inconsistent with the Coastal Zone Management Plan of the Territory of the U. S. Virgin Islands.

IV.B.2. Alternative 4. Proposed Action – Sustained Reduction

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values are enhanced under this alternative as the native faunal species previously depredated by non-native cats' increase, resulting in more native fauna sightings because cats would no longer continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetic environment near dumpsters may be enhanced as trash being pulled out of the dumpsters by cats is reduced or eliminated.

Cultural Resource Impacts

No adverse cultural resource impacts would be expected under this alternative.

Socioeconomic/Visitor Use Impacts

Visitor use patterns should be enhanced with a possible tourism increase under this alternative. Potential visitors who opted to vacation in another area as the result of media coverage or word-of-mouth communication about cat transmitted disease problems may visit when the vector for these diseases is removed. The tourist experience, especially at Trunk Bay, Francis Bay and Cinnamon Bay Camps, Inc, for example, would be safer, healthier, and improved.

Soil Impacts

No significant soil impacts would occur under this alternative.

Threatened and Endangered Species Impacts

Non-native cats depredate chicks, juveniles and adults of all birds nesting on St. John. Of particular concern is depredation to Endangered Brown Pelicans (*Pelecanus occidentalis*) and Least Terns (*Sterna antillarum*), and the Threatened Roseate Terns (*Sterna dougallii*). Cats may also predate hatchlings sea turtles, Hawksbill and Green, as they travel from nest to the sea at night. Cats also may depredate four (of the five) native bat species, three of which are Territorially Endangered, and the only indigenous mammals on the island. Other Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck and Antillean Mango Hummingbird, all of which suffer egg and chick depredation due to cats. The Sea Turtle Recovery Plans stipulate that predators should be removed from nesting sites.

The proposed action would not adversely impact any federally listed threatened or endangered species here or Territorially listed endangered or rare species. The baits used would not produce secondary toxicity, and the trapping methods used would not entrap any threatened or endangered species (Campbell 1989, Conry 1994, and Witmer *et. al.* 1998).

Vegetation Impacts

There would be no change in the type or level of impacts to native vegetation under this alternative.

Wildlife Impacts

Wildlife impacts would be positively mitigated by this action because significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species would benefit when non-native cat populations are kept low. In addition, five native bat species, the only indigenous mammals on the island, would benefit from reduced predation.

Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from cat depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. Non-native cats prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has

listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are preyed upon by non-native cats.

Non-native cats routinely kill insects and other small animals for sport, play, pleasure, practice or for no apparent reason, in addition to using them as a food source, therefore, great numbers of wildlife are lost each year to a small non-native cat population. Both the cumulative impact and the secondary impacts associated with these increasing wildlife losses are of significant importance. Small islands tend to have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts to a larger landmass.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

Wetlands and floodplains impacts are mitigated under this alternative. More native flora and fauna would exist in and adjacent to these areas as foraging and predation pressure from non-native cat's decrease because non-native cats would not longer be preying upon wildlife species that live in these wetland habitats.

Park Operations Impacts

Under this alternative, the overall costs of administration of the non-native wildlife control program would be increased with the implementation of contracts to remove exotic wildlife (\$30,000 with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division), purchase and installation of animal-proof trash receptacles and garbage cans, animal-proofing park and concessionaire structures, and construction of fences to exclude non-native animals from some developed areas.

Cumulative Impacts

The cumulative impacts from this alternative would have essentially no negative consequences for National Park Service lands, wildlife and marine waters. Some visitors would see live traps and would then have the opportunity to ask questions and learn about wildlife remediation efforts and their importance to small sensitive ecosystems. Wildlife control programs in St. John mirror similar programs throughout the world. Visitors would be afforded the opportunity to experience an U.S. National Park actively protecting the wildlife and habitat for which it was founded to preserve for future generations. These are all extremely favorable, transferable and global aspects of this wildlife control alternative.

Fewer non-native cats would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities. A very small non-native cat population level should result in a small number of cats that actively avoid human habitations in both day and night time. New non-native cats are expected to occasionally enter centers of human activity and these would be promptly trapped and removed.

The Park's recently approved Commercial Services Plan/Final EA (2001) identified the need to establish a new mobile unit food services operation at Hawksnest Bay and new commercial services contracts for Trunk Bay and Cinnamon Bay Campground concessions. An integrated pest management approach would be included in any contract language that minimizes the adverse affects of non-native cats on Park facilities, daily concession operations and public safety.

This favorably affects and is, therefore, consistent with the approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Territory of the U. S. Virgin Islands.

IV.C. Non-native Mongoose Control

IV.C.1. Alternative 5. No Action

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values would decline under this alternative as the native faunal species depredated by non-native mongooses continue to decrease in numbers because mongooses would continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetics near dumpsters would decline and trash would be scattered into the bush and nearby roadside.

Cultural Resource Impacts

Cultural resource impacts would remain the same at historic sugar plantations throughout the Park under this alternative.

Socioeconomic/Visitor Use Impacts

Tourism may decrease slightly under this alternative. Visitor experiences would decline because they may visit fewer sites and stay shorter periods if they have negative experiences at the sites. This is especially true if people experience non-native mongooses at several sites during their visit, including picnic tabletops, in and around sleeping quarters and dumpsters. Moreover, the ear-piercing aggressive screeching sound offered by many frightened adult mongooses, as warning of danger to other mongooses can be frightening.

Soil Impacts

No significant soil impacts would occur under this alternative.

Threatened and Endangered Species Impacts

Non-native mongoose would continue to predate listed species. In St. John the listed species include the Endangered Hawksbill and Leatherback sea turtles, Endangered Brown Pelicans and Least Terns, and Threatened Roseate Terns. Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove and Bahama Pintail Duck, both of which suffer egg and chick depredation due to mongooses.

Vegetation Impacts

There would be no change in the type or level of impacts to native vegetation under this alternative. This is particularly important in the dry season, when fruit from non-native tree species are sometimes consumed for their moisture content. This can result in more seeds from exotic plant species being dispersed in fecal matter. This complex ecological problem is exacerbated over time as the accumulative affects multiply and have a greater influence on the vegetation island-wide, as well as the fauna and small ecosystems found within the vegetation.

Wildlife Impacts

Native wildlife would be adversely impacted by this action because non-native mongooses depredate significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species.

Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from non-native mongoose depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island.

Non-native mongoose prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are preyed upon by non-native mongooses. Many invertebrate species may be lost before researchers have even catalogued them.

Both the accumulative impact and the secondary ecological impacts associated with these increasing wildlife losses are of significant importance. Small islands tend to have both smaller resident wildlife populations and lower species diversity. To exacerbate matters, non-native mongooses depredate a wide range of fauna, including ground and shrub-nesting birds and waterfowl, every native species of reptile and amphibian and literally hundreds of invertebrate species. These problems are particularly problematic on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and magnified when compared with similar impacts to a larger landmass.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

Adverse impacts to wetlands, mainly saltponds, would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of non-native mongooses throughout the Park decrease because non-native mongoose would no longer be preying upon wildlife species that live in these wetland habitats. This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation, Francis Bay, etc.

Park Operations Impacts

Under this alternative, NPS would continue to animal-proof trash receptacles and dumpsters at campgrounds, day use sites, concession areas, park overlooks, and employee housing areas. During the last year, Virgin Islands NP has purchased and installed over 50 pre-manufactured animal-proof trash containers (at a cost of about \$75,000) at all Park sites except at the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested \$30,000 in funding to purchase and install an additional 20 pre-manufactured animal-proof trash containers at major concession operations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a donkey-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of \$67,000.

Cumulative Impacts

The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife. Almost every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in wildlife species

composition and the associated changes in native flora. Eventually, many species would become locally extinct, many before they are even identified by researchers.

Health and sanitation impacts would not be mitigated under this action. Health and sanitation impacts would continue to decline under this action. More non-native mongooses could potentially disperse more disease causing organisms in more places, including tents, picnic tables, sinks and bathing facilities. Some people may choose not to visit St. John as a result, and those who do may reduce their stay and have a negative experience. This is certainly true as non-native mongoose's forage for food in the daytime.

Moreover, the Park offers visitors a negative interpretative message that highlights the problems encountered when non-native species are not managed. In addition, the Park fails to protect the natural resources for enjoyment of future generations; the fundamental premise for which the Virgin Islands National Park was founded.

This alternative adversely affects approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Virgin Islands for reasons described above. The National Park Service has, therefore, determined that the proposed action is inconsistent with the Coastal Zone Management Plan of the Territory of the U. S. Virgin Islands.

IV.C.2. Alternative 6. Proposed Action – Sustained Reduction

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative.

Scenic Values

Scenic values would be enhanced under this alternative as the native faunal species depredated by non-native mongoose's increase in numbers, resulting in more native faunal sightings because mongooses would no longer continue to eat many types of wildlife that the public hopes to see during a visit to VINP. The aesthetic environment near dumpsters would be enhanced when trash and food wastes are not seen and offensive odors are reduced.

Cultural Resource Impacts

No significant adverse cultural resource impacts would be expected under this alternative.

Socioeconomic/Visitor Use Impacts

Visitor use patterns should be enhanced under this alternative as non-native mongooses no longer steal or damage food items belonging to campers or picnickers. Fewer non-native mongooses would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities. Maintaining a "residual" mongoose population level should result in mongooses that avoid human habitations and activity centers.

Soil Impacts

No significant soil impacts would occur under this alternative.

Threatened and Endangered Species Impacts

Non-native mongooses are often primary predators of Endangered Hawksbill (*Eretmochelys imbricata*) and Leatherback (*Dermochelys coriacea*) sea turtles and Threatened Green (*Chelonia mydas*) sea turtles that nest on the island (Nellis and Small 1983; Boulon 1999). Mongooses would depredate sea turtle

nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones. They would also predate a nest just before or immediately after hatching as the emergent hatchling crawl from the nest to the ocean in the early morning hours, when mongooses begin to hunt. Often, hatchlings trickle from their nesting cavity over a period of several hours, leaving them susceptible to mongoose predation in the daytime. Often, mongooses depredating sea turtle nests enter a “feeding frenzy” behavior, during which they kill and maim every sea turtle, while eating just a small number. The Sea Turtle Recovery Plans stipulate that predators should be removed from turtle nesting beaches.

Territorial endangered species depredated by mongooses include ground and tree nesting species such as Bridled Quail Dove and Bahama Pintail Duck, both of which suffer egg and chick depredation due to non-native mongooses.

The proposed action would not adversely impact any federally listed threatened or endangered species or Territorially listed endangered or rare species. The baits used would not produce secondary toxicity, and the trapping methods used would not entrap any threatened or endangered species (Campbell 1989, Conry 1994, Witmer *et. al.* 1998).

Vegetation Impacts

There would be no change in the type or level of impacts to native vegetation under this alternative.

Wildlife Impacts

Wildlife impacts would be positively mitigated by this action because significant numbers of native fauna including several native bird species would benefit when non-native mongoose populations are kept low. Non-native mongooses depredate eggs, chicks or adults from shorebird, waterfowl and other birds nesting on or near the ground. Likewise, numerous species of reptiles would benefit from reduction of non-native mongoose populations because mongooses would no longer be preying upon eggs, young and adults.

Water Quality Impacts

No adverse water quality impacts would be expected under this alternative.

Wetlands/Floodplain Impacts

No adverse impacts to wetlands and floodplains would be expected under this alternative.

Park Operations Impacts

Under this alternative, the overall costs of administration of the non-native wildlife control program would be increased with the implementation of contracts to remove exotic wildlife (\$30,000 with the U.S. Department of Agriculture’s Animal Plant Health Inspection Service / Wildlife Services Division), purchase and installation of animal-proof trash receptacles and garbage cans, animal-proofing park and concessionaire structures, and construction of fences to exclude non-native animals from some developed areas.

Cumulative Impacts

The cumulative impacts from this alternative would have no negative consequences for National Park Service lands, wildlife and marine waters.

Fewer non-native mongooses would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities. Maintaining a “residual” mongoose population level should result in mongooses that avoid human habitations and activity centers.

The Park's recently approved Commercial Services Plan/Final EA (2001) identified the need to establish a new mobile unit food services operation at Hawksnest Bay and new commercial services contracts for Trunk Bay and Cinnamon Bay Campground concessions. An integrated pest management approach would be included in any contract language that minimizes the adverse affects of non-native mongooses on Park facilities, daily concession operations and public safety.

This favorably affects and is, therefore, consistent with the approved Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Territory of the U. S. Virgin Islands.

IV.D. Comparison of Alternatives

This section describes the alternatives that were analyzed in this environmental assessment for non-native rat, cat, and mongoose control in Virgin Islands National Park. The alternatives include no action (1, 3 and 5), and the proposed actions - sustained reduction (2, 4 and 6).

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.B.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Air Quality Impacts	No adverse impacts would be expected.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Scenic Values	Highest potential for adverse impacts as trash is widely scattered and rats kill native flora and fauna.	Lowest potential for adverse impacts as trash is not widely scattered. Food wastes are not seen and offensive odors are reduced.	Highest potential for adverse impacts as trash is widely scattered and cats kill native flora and fauna.	Lowest potential for adverse impacts as trash is not widely scattered. Food wastes are not seen and offensive odors are reduced.	Highest potential for adverse impacts as trash is widely scattered and mongooses kill native flora and fauna.	Lowest potential for adverse impacts as trash is not widely scattered. Food wastes are not seen and offensive odors are reduced.
Cultural Resources Impacts	Highest potential for adverse impacts as burrowing, vegetation grazing and seed dispersal would continually undermine historic structures. Fecal and urine contamination would continue unabated.	Lowest potential for adverse impacts as burrowing, vegetation grazing and seed dispersal caused by rats would be greatly reduced. This would result in safer, cleaner, healthier and more stable structures for interpretation and enjoyment.	Cultural resource impacts would remain unchanged.	Cultural resource impacts would remain unchanged.	Highest potential for adverse impacts as burrowing, vegetation grazing and seed dispersal would continually undermine historic structures. Fecal and urine contamination would continue unabated.	Lowest potential for adverse impacts as burrowing, vegetation grazing and seed dispersal caused by mongooses would be greatly reduced. This would result in safer, cleaner, healthier and more stable structures for interpretation and enjoyment.
Socio-economic/ Visitor Use Impacts	Tourism may decrease slightly as all Park sites would continue to be adversely impacted by rats entering tents, eating food and other items and depositing fecal materials on personal belongings.	Tourism would be enhanced at all Park sites since visitors would no longer be adversely impacted by rats entering tents, eating food and other items and depositing fecal materials on personal belongings. The visitor experience would be significantly improved.	Tourism may slightly decrease, especially overnight stays, if people experience starving, emaciated and begging cats at several Park sites. Increases in cat transmitted disease among visitors would affect use levels and the quality of the visitor experience.	Tourism would be enhanced at all Park sites, especially at Trunk Bay, Francis Bay and Cinnamon Bay Camps, Inc. The public would no longer experience starving, emaciated and begging cats at these sites. The visitor experience would be much safer, healthier and improved.	Tourism may decrease slightly at all Park sites if the public would continue to be adversely impacted by mongooses entering tents, eating food and other items and depositing fecal materials on personal belongings.	Tourism would be enhanced at all Park sites as mongooses would no longer steal or damage food items belonging to campers or picnickers.

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.B.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Soil Impacts	Highest potential for adverse affects as increased tunneling within, under and adjacent to historic or modern structures could decrease their stability. More tunnels within which seeds are transported would undermine the stability and integrity of all buildings and especially the cultural landscape.	Lowest potential for adverse impacts as decreased tunneling and fewer tunnels would increase the stability of historic or modern structures. Fewer tunnels within seeds are transported would no longer undermine the stability and integrity of all buildings and especially the cultural landscape.	No adverse impacts would be expected.	No adverse impacts would be expected.	No adverse impacts would be expected.	No adverse impacts would be expected.
Vegetation Impacts	Highest potential for adverse affects from rats in the Park would be continuing impacts to native vegetation. This is particularly important in the dry season, when bark and leaves are consumed for their moisture content. In addition, fewer seeds from non-native plant species would be dispersed in fecal matter and in burrows. This complex ecological problem is exacerbated over time as the accumulative affects multiply and have a greater influence on the vegetation island-wide, as well as the fauna and micro-habitats found within the vegetation.	Lowest potential for adverse impacts because fewer rats would consume less native flora and enhance because fewer rats would consume less vegetation. This is particularly important in the dry season, when bark and leaves are consumed for their moisture content. Also, fewer seeds from non-native plant species would be dispersed in fecal matter and in burrows.	No adverse impacts would be expected. Impacts to native vegetation would remain unchanged under this alternative.	No adverse impacts would be expected. Impacts to native vegetation would remain unchanged under this alternative.	Highest potential for adverse affects from mongooses in the Park would be continuing impacts to native vegetation. This is particularly important in the dry season, when fruit from non-native tree species are sometimes consumed for their moisture content. This can result in more seeds from non-native plant species being dispersed in fecal matter. This complex ecological problem is exacerbated over time as the accumulative affects multiply and have a greater influence on the vegetation island-wide, as well as the fauna and small ecosystems found within the vegetation.	Lowest potential for adverse impacts because fewer mongooses would consume native flora. Native vegetation impacts remain unchanged under this alternative.

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.B.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Threatened/Endangered Species Impacts	<p>Highest potential for adverse affects since the Park would be violating the Endangered Species Act (ESA) for failing to actively remove or destroy species that are known to predate listed species. In St. John the listed species include the Endangered Hawksbill and Leatherback sea turtles, Endangered Brown Pelicans and Least Terns, and Threatened Roseate Terns.</p> <p>Rats also depredate four (of the five) native bat species, three of which are Territorially Endangered, and the only indigenous mammals on the island. Other Territorial Endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail duck and Antillean Mango hummingbird, all of which suffer egg and chick death due to rats.</p>	<p>Lowest potential for adverse impacts because Norway and roof rats would no longer be killing the eggs or chicks from all birds nesting on St. John. Of particular concern is depredation to Endangered Brown Pelicans, Least Terns, and the Threatened Roseate Terns.</p> <p>Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail duck and Antillean Mango hummingbird, all of which suffer egg and chick depredation due to rats.</p> <p>Rats are not primary predators of Endangered Hawksbill and Leatherback sea turtles which nest on the island, however, rats are involved in predation events each year. Both Norway and roof rats depredate emergent hatchlings as they crawl from the nest to the ocean at night, when the rats are most active. The sea turtle recovery plans stipulate that predators should be removed from turtle nesting beaches.</p>	<p>Highest potential for adverse affects since the Park would be violating the Endangered Species Act for failing to actively remove or destroy species, which are known to predate, federally listed species. On St. John the listed species include the Endangered Brown Pelican, Least Tern and Hawksbill turtle, and Threatened Roseate Tern and Green turtle.</p> <p>Cats also depredate four (of the five) native bat species, three of which are Territorially endangered, and the only indigenous mammals on the island.</p> <p>Other Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail duck and Antillean Mango hummingbird, all of which suffer egg and chick death to cats.</p>	<p>Lowest potential for adverse impacts because cats depredate chicks, juveniles and adults of all birds nesting on St. John. Of particular concern is depredation to Endangered Brown Pelicans, and Least Terns, and the Threatened Roseate Terns.</p> <p>Cats may also predate hatchlings sea turtles, Hawksbill and Green, as they travel from nest to the sea at night.</p> <p>Cats also may depredate four (of the five) native bat species, three of which are Territorially Endangered, and the only indigenous mammals on the island.</p> <p>Other Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail duck and Antillean Mango hummingbird, all of which suffer egg and chick death due to cats. The Endangered Species Act stipulates that predators should be removed from nesting sites and noncompliance is therefore a violation of the ESA.</p>	<p>Highest potential for adverse affects since the Park would be violating the Endangered Species Act for failing to actively remove or destroy species, which are known to predate, listed species. In St. John the listed species include the Endangered Hawksbill and Leatherback sea turtles, Endangered Brown Pelicans and Least Terns, and Threatened Roseate Terns.</p> <p>Territorial endangered species include ground and tree nesting species such as Bridled Quail Dove and Bahama Pintail duck, both of which suffer egg and chick depredation due to mongooses.</p>	<p>Lowest potential for adverse impacts because mongooses are often primary predators of Endangered Hawksbill and, Leatherback sea turtles and Threatened Green sea turtles that nest on the island. Mongooses would depredate sea turtle nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones.</p> <p>They would also predate a nest just before or immediately after hatching as the emergent hatchlings crawl from the nest to the ocean in the early morning hours, when mongooses begin to hunt.</p> <p>Often, mongooses depredating sea turtle nests enter a "feeding frenzy" behavior, during which they kill and maim every sea turtle, while eating just a small number. The sea turtle recovery plans stipulate that predators should be removed from turtle nesting beaches and noncompliance is therefore a violation of the ESA</p>

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.B.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Wildlife Impacts	<p>Highest potential for adverse affects from rats in the Park on native wildlife would continue because significant numbers of native fauna including several native bird, reptile and amphibian species and numerous insect and spider species are killed by Norway and roof rats.</p> <p>Because herpto-fauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from rat depredation.</p>	<p>Lowest potential for adverse native wildlife impacts because Norway and roof rats populations would be significantly reduced.</p> <p>Significant numbers of native fauna, including several native bird, reptile and amphibian species and numerous insect and spider species would benefit when the Norway and roof rat populations are kept low.</p> <p>In addition, five native bat species, the only indigenous mammals on the island, would benefit from reduced predation.</p> <p>Many birds, three bat and one reptile species are Locally Endangered by the Government of the U.S. Virgin Islands.</p>	<p>Highest potential for adverse affects from cats in the Park on native wildlife would continue.</p> <p>Native wildlife would continue to be adversely impacted because cats depredate significant numbers of native fauna including several native birds, reptile and amphibian species and numerous insect and spider species.</p> <p>Because herpto-fauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from cat depredation.</p> <p>Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island.</p> <p>The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species.</p>	<p>Lowest potential for adverse native wildlife impacts because cat populations would be significantly reduced.</p> <p>Wildlife impacts would be positively mitigated by this action because significant numbers of native fauna including several native birds, reptile and amphibian species and numerous insect and spider species would benefit when cat populations are kept low.</p> <p>In addition, five native bat species, the only indigenous mammals on the island, would benefit from reduced predation.</p> <p>Because herpto-fauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from cat depredation.</p> <p>Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island.</p>	<p>Highest potential for adverse affects from mongooses in the Park on native wildlife would continue.</p> <p>Native wildlife would continue to be adversely impacted by this action because mongooses depredate significant numbers of native fauna including several native birds, reptile and amphibian species and numerous insect and spider species.</p> <p>Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extinction from mongoose depredation.</p> <p>Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island.</p> <p>The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species.</p>	<p>Lowest potential for adverse native wildlife impacts because mongoose populations would be significantly reduced.</p> <p>Wildlife impacts would be positively mitigated by this action because significant numbers of native fauna including several native bird species would benefit when mongoose populations are kept low.</p> <p>Mongooses depredate eggs, chicks or adults from shorebird, waterfowl and other birds nesting on or near the ground. Likewise, numerous species of reptiles would benefit from reduction of mongoose populations.</p>

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.B.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Water Quality Impacts	No adverse impacts would be expected.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Wetlands/ Floodplain Impacts	<p>Highest potential for adverse affects from Norway and roof rats in the Park on native wildlife using wetlands and floodplains would continue.</p> <p>Adverse impacts to wetlands, mainly saltponds, would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of rats throughout the Park.</p> <p>This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation, Francis Bay, etc.</p>	<p>Lowest potential for adverse native wildlife impacts because Norway and roof rats populations would be significantly reduced in and adjacent to Park wetlands and floodplains.</p> <p>Wetlands and floodplains impacts are mitigated under this alternative.</p> <p>More native flora and fauna would exist in and adjacent to these areas as foraging and predation pressure from rats' decrease.</p>	<p>Highest potential for adverse affects from cats in the Park on native wildlife using wetlands and floodplains would continue.</p> <p>Adverse impacts to wetlands, mainly salt ponds, and would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of cats throughout the Park.</p> <p>This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation, Francis Bay, etc.</p>	<p>Lowest potential for adverse native wildlife impacts because cat populations would be significantly reduced in and adjacent to Park wetlands and floodplains.</p> <p>Wetlands and floodplains impacts are mitigated under this alternative.</p> <p>More native flora and fauna would exist in and adjacent to these areas as foraging and predation pressure from cat's decrease.</p>	<p>Highest potential for adverse affects from mongooses in the Park on native wildlife using wetlands and floodplains would continue.</p> <p>Adverse impacts to wetlands, mainly saltponds, would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressure of mongooses throughout the Park.</p> <p>This is especially problematic where salt ponds occur near centers of human activities, e.g. Annaberg Sugar Plantation, Francis Bay, etc.</p>	<p>Lowest potential for adverse native wildlife impacts because mongoose populations would be significantly reduced in and adjacent to Park wetlands and floodplains.</p>

	Alternative 1 - II.A.2	Alternative 2 - II.A.3	Alternative 3 - II.C.2	Alternative 4 - II.B.3	Alternative 5 - II.C.2	Alternative 6 - II.C.3
Impact Category	Non-native Rats Control	Non-native Rats Control	Non-native Cats Control	Non-native Cats Control	Non-native Mongooses Control	Non-native Mongooses Control
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Cumulative Impacts	<p>Highest potential for adverse cumulative affects from non-native Norway and roof rats in the Park.</p> <p>The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife. Every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative.</p> <p>The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, bats, tree frogs and insect species.</p> <p>Eventually, many species would become locally extinct, some before they are even identified by scientists.</p>	<p>Lowest potential for adverse cumulative affects from non-native Norway and roof rats in the Park.</p> <p>The cumulative impacts from this alternative would have no negative consequences for National Park Service lands, wildlife and marine waters.</p> <p>Fewer rats would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities.</p> <p>Maintaining a “residual” rat population level should result in rats that avoid human habitations in both day and night time.</p>	<p>Highest potential for adverse cumulative affects from non-native cats in the Park.</p> <p>The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife.</p> <p>Every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, bats, tree frogs and insect species.</p> <p>Eventually, many species would become locally extinct, some before they are even identified by researchers.</p>	<p>Lowest potential for adverse cumulative affects from non-native cats in the Park.</p> <p>The cumulative impacts from this alternative would have essentially no negative consequences for National Park Service lands wildlife and marine waters.</p> <p>Some visitors would see live traps and would then have the opportunity to ask questions and learn about wildlife remediation efforts and their importance to small sensitive ecosystems.</p> <p>Wildlife control programs in St. John mirror similar programs throughout the world. Visitors would be afforded the opportunity to experience an U.S. National Park actively protecting the wildlife and habitat for which it was founded to preserve for future generations.</p>	<p>Highest potential for adverse cumulative affects from non-native mongooses in the Park.</p> <p>The cumulative impacts from this alternative would have severe negative consequences for National Park Service lands and wildlife.</p> <p>Almost every native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in wildlife species composition and the associated changes in native flora.</p> <p>Eventually, many species would become locally extinct, many before they are even identified by scientists.</p>	<p>Lowest potential for adverse cumulative affects from non-native mongooses in the Park.</p> <p>The cumulative impacts from this alternative would have no negative consequences for National Park Service lands, wildlife and marine waters.</p> <p>Fewer mongooses would disperse less disease causing organisms in tents, on picnic tables, in restrooms and bathing facilities.</p> <p>Maintaining a “residual” mongoose population level should result in mongooses that avoid human habitations and activity centers.</p>

V. CHAPTER V. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

The proposed program for a sustained reduction of non-native rat, non-native cat and non-native mongoose populations from Virgin Islands National Park is consistent with the National Park Service Organic Act (16 U.S.C.) “to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the same in such a manner and by such means as would leave them unimpaired for the enjoyment of future generations.”

(a) Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)(7 U.S.C. 136 *et seq.*) – The rodenticide proposed for use diaphacione (Eaton’s Bait Blocks) is a general use product registered by the Environmental Protection Agency for use in and around man-made structures. In order to use this product in the natural area at Virgin Islands National Park, the NPS and Wildlife Services has obtained a special Section (c) registration for the product through the Government of the Virgin Islands’ Department of Planning and Natural Resources Division of Environmental Protection. This permit is consistent with the FIFRA. The Park has also obtained pesticide use approval through the Southeast Regional Integrated Pest Management Program (IPM) and the Washington IPM Office.

(b) Endangered Species Act of 1973 (ESA)(7 U.S.C. 136, as amended) – Virgin Islands National Park provides habitat for Endangered Hawksbill and Leatherback sea turtles at numerous beach areas along the north, east and southern beaches. Endangered Brown Pelicans nest extensively along a section of the north shore area. Endangered Roseate and Threatened Least Terns nest at several sites in the Park. In order to comply with the ESA of 1973, the Park must protect endangered species and their habitats (PL 93-205). NPS initiated consultation about this program with the U.S. Fish and Wildlife Service on April 16, 2001. A response letter from U.S. Fish and Wildlife Service on September 7, 2001 indicated that there are no adverse effects on listed species from the proposed action, thereby concluding consultation under Section 7 of the Endangered Species Act.

(c) Migratory Bird Treaty Act of 1918 (40 Stat 755) provided clear authority and direction for the proposed action.

(d) Animal Damage Control Act of 1931 gives authority to remove injurious animals for the protection of birds and other wildlife.

(e) Coastal Zone Management Act (16 U.S.C. 1 {1916} *et seq.*) “Preserve, protect, develop and where possible restore or enhance the resources of the nation’s coastal zones” supports the removal of non-native pests that damage the coastal zone and wildlife therein. With release of Draft EA, NPS initiated formal consultation with the Territory’s Department of Planning and Natural Resources in conformance with the Coastal Zone Management Act; this consultation is ongoing.

(f) General Management Plan – Virgin Islands National Park, 1983 – non-native and non-native pests such as rats and mongooses, as well as non-native cats, are identified as a threat to native fauna and flora and must be controlled.

(g) National Historic Preservation Act of 1966 (16 U.S.C. 470 *et seq.*), Archeological Resources Protection Act of 1979 (16 U.S.C. 470aa-11). With release of Draft EA, on June 18, 2001, NPS initiated formal consultation with the State Historic Preservation Office regarding effects on the

Park's archeological and cultural resources. This office expressed no concerns about the proposed program.

- (h) **National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4332, as amended).** Title I of NEPA require that federal agencies plan and carry out their activities..."so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment." With release of Final EA, NPS will complete the NEPA process.
- (i) **Resource Management Plan – Virgin Islands National Park, 1999** – non-native and non-native pests such as non-native rats and non-native mongooses, as well as non-native cats, are identified as a threat to native fauna and flora and must be controlled.

VI. CHAPTER VI. CONSULTATION AND COORDINATION

Personnel from the following agencies and organizations have been consulted or participated in the formulation of this Environmental Assessment:

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IX. CHAPTER IX. APPENDICES

APPENDIX A. List of Endangered Plants and Animals of the U. S. Virgin Islands

APPENDIX B. List of Introduced Animals to St. John, U. S. Virgin Islands

APPENDIX C. Sample Eaton Bait Blocks Rodenticide 24c Label

APPENDIX D. The Wildlife Society Position Statement Concerning Feral Domestic Cats

APPENDIX E. Consultation Letter from U. S. Fish and Wildlife Service